JUNE 1961

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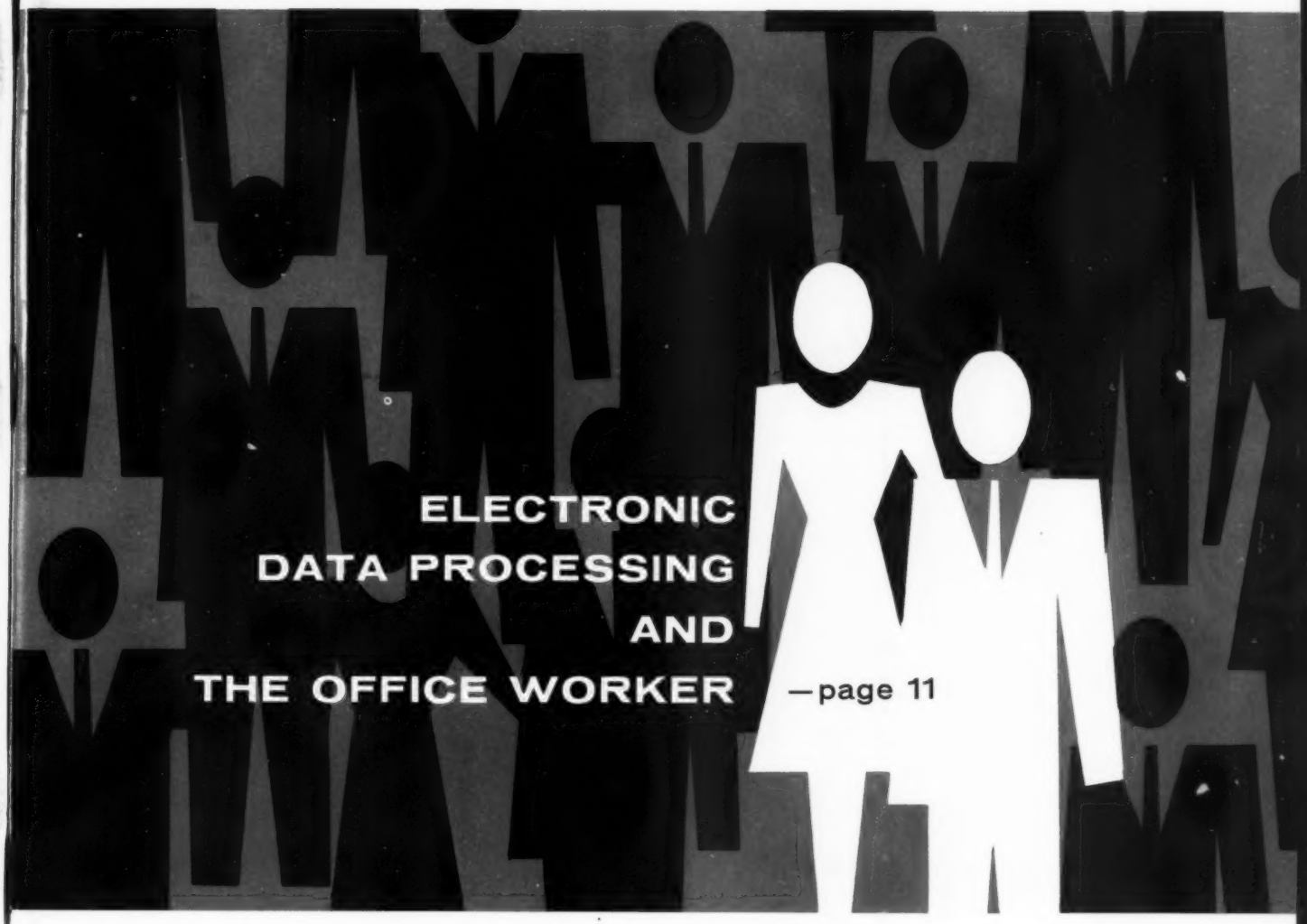

ELECTRONIC DATA PROCESSING AND THE OFFICE WORKER

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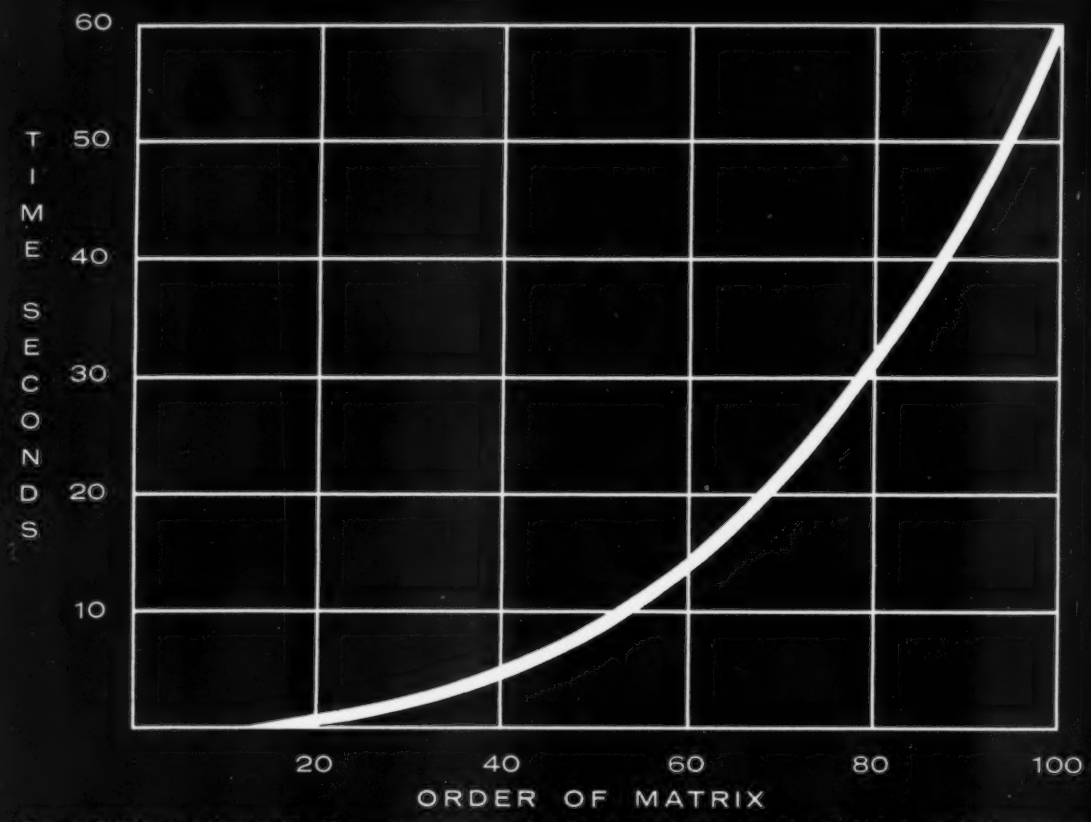
Fast Matrix Inversion



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Volume Three • Number Six

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OBSERVATIONS . . .
from the publisher

The "DP-PD Problem"

DATA PROCESSING AND PERSONNEL DISPLACEMENT is likely to get more than its deserved share of press coverage in the immediate future. The automobile industry union contract negotiations will undoubtedly focus public attention on factory automation and much of this will "rub off" on business data processing. And the facts are likely to get distorted.

We are convinced technological developments led by the high speed computer will bring a new era of prosperity and upgrade human effort.

In the process American business will have to overcome some problems. Among these is possible personnel displacement. **But each management group must solve its own problem.** The alternative could be a degree of "national action" that could in itself be disastrous. And we have no doubt that American business will solve these problems with the same vision and determination that have given America the highest living standard in the world.

In this issue we draw attention to several views on the PD question:

P. 5 The new head of the U. S. Office of Automation and Manpower states his department's intentions.

P. 11 An industrial relations expert presents a fairly "liberal" view.

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AUTHORS

ALBERT A. BLUM (*Electronic Data Processing and the Office Worker*), a graduate of City College of New York, received his Ph.D. from Columbia University. He taught industrial relations at New York University, the New York State School of Industrial and Labor Relations at Cornell University, and at The American University. At present, he is a member of the faculty at Michigan State University where he teaches in the Social Science Department and where he is associated with the Labor and Industrial Relations Center.

Professor Blum is well known for his writings in the field of industrial relations. While a member of the staff of the National Industrial Conference Board, he was co-author of two studies, *Unionization among American Engineers* and *Labor Relations in the Atomic Energy Field*. He has also written many articles dealing with labor relations for journals such as *Management Record, Labor Law Journal, Southwestern Social Science Quarterly*, among others. A study of his dealing with company insurance organization will shortly be published by the American Management Association. He is presently writing a book, to be entitled *Soldier or Worker: A Study of the Draft during the Second World War*.

□

RAYMOND DREYFACK (*Scientific Personnel Selection*), is well known to readers of *Data Processing* for his monthly column on Personnel. He was educated in accountancy at City College of New York and New York University and specialized in writing and journalism at Columbia University. Mr. Dreyfack is director of data processing

systems for Fabergé Perfumes of Ridgefield, New Jersey. His feature article, "Data Processing Is Not a World of Its Own," appeared in the February 1960 issue.

□

SAMUEL D. HARPER (*Automatic Parallel Processing*), manager of the Computer Department, Special Systems Division of Minneapolis-Honeywell, until recently was director of sales engineering. He began, in 1957, to work on systems development for the Datamatic 1000 computer and was project director on the design and early stages of manufacture of the Honeywell 800.

Prior to joining Honeywell, Mr. Harper did extensive electronic telephone exchange work at the Dollis Hill Research Station in London, England. He also served with the Royal Navy Scientific Service as leader of its computer research and development group. Earlier he spent two years with the General Electric Company at Coventry.

A native of Yorkshire, he graduated from Bradford Technical College with diplomas in electrical engineering and power transmission, and later received a B.Sc. degree in electrical engineering from London University. He is a member of the Institute of Electrical Engineers, London, and a senior member of the I.R.E.

□

ERNEST S. KRAFT (*Computer Conversion Program*) has been employed with Philips Electronics Industries Ltd. of Toronto, Ontario, since 1954 and is presently, as methods analyst, in charge of the preparations for the 1401, including systems analysis and programming.

A commerce graduate of the University of Vienna, he was engaged in accounting and cost accounting work in Austria for 17 years.

He is a member of the Society of Industrial and Cost Accountants and of the National Machine Accountants Association.

□

FRANKLIN VANDEN BOSCH (*The Human Element*), has been active in the development of machine data processing methods in public utilities for over thirty-five years. After some prior experience in both Michigan and Southern California, he joined the Tabulating Bureau of The Detroit Edison Company in 1926.

Here he applied machine processing methods to accounting procedures. He found every new machine to be a means for mechanizing another phase of Edison's accounting, until their operations in this area became an outstanding example of integrated data processing in a utility.

During the twelve years that he headed the planning functions, he also developed a job time and cost control system for the electric accounting machine organization. Following this he served in various management positions and was appointed assistant director of machine data processing in 1958. His department is responsible for electronic data processing as well as electric accounting machine operations. ■

COMMENTS

Creative thinking

Boston, Massachusetts

Dear Sirs:

Just finished reading "Creative Thinking" in the March issue.

I have been using "Brain Storming" here in my installation for over five months and I am very pleased with it.

I find the by-products almost as worthwhile as the problem solving aspect. By that I mean I find the morale improved by these sessions, and the overall interest much improved.

We have attacked several of our procedural problems and the results have been very rewarding.

Lloyd C. Peterson, Director
Office of Tabulating Service
Boston University

Nice to hear

Newark, New Jersey

Dear Sirs:

. . . If you are interested in the opinion of one of your readers, we feel your monthly magazine, *Data Processing*, is one of two magazines in the field that do the best job of covering worthwhile material in a current and interesting manner.

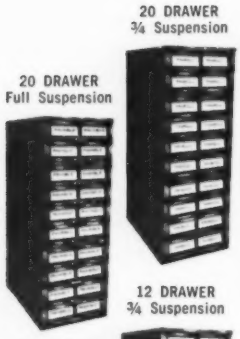
Arthur N. Nichols
Assistant Superintendent
The American Insurance Group

SPECIAL TO DATA PROCESSING

OFFICE OF AUTOMATION AND MANPOWER

By Seymour L. Wolfbein
Deputy Assistant Secretary
U.S. Department of Labor

THE NEW OFFICE of Automation and Manpower takes this as its basic premise: Automation and technological development are absolutely necessary to our aspirations for our own economy and vital to our international posture. By the same token, however, the necessity is equally critical to mitigate and even prevent the impact of these changes on our unemployment situation. Our new office will consider four major pathways toward achieving this goal. The first is to collect as much information as possible—in fact, set up an early warning system—on what are the upcoming technological innovations. At the same time, we hope to collect information on the impact of these changes on workers and how they adapt themselves to these changes. The second involves the communication of this information to all who are interested and concerned with this problem. The third involves recommending steps to labor, management and government, on what can be done to ameliorate the impact of technological change. And the fourth involves recommendations concerning education, training, skill development, improvement of mobility, etc., which will move toward the prevention, as far as is possible, of technological unemployment.



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NEWS SUMMARY

FINANCIAL

Farrington's 1960 volume exceeded the previous year's by 59 per cent, with loss of $1,893,351 due to increased research and development, marketing activities increase for optical scanner, and introduction of new data processing lines.

First quarter for IBM showed net profit of almost $49 million, with $2.67 a share dividend.

March was a happy financial month for Standard Register, being the best in its 49 years.

ODDS AND ENDS

Almost 30 large companies are now shipping a single reel of magnetic tape, in place of hundreds of paper sheets, to the social security recordkeeping headquarters each quarter. These firms use electronic data processing equipment to prepare payrolls and the tape is a by product.

System Development Corporation (SDC) has a grant from the U.S. Office of Education for researching a computer-based teaching machine to select and organize educational material for high schools.

Remington Rand held its first class in COBOL techniques for Univac users; the two week introductory course was followed by a four week workshop.

Philco has been conducting a series of one day management computer seminars; the first group met in May and others are scheduled for June 6, June 20 and July 11.

Philco has a permanent public exhibit in Washington, D. C. showing the diversification of an American industry and its relationship to the consumer and industrial welfare.

EXPANSION

The Information Processing Technology Division is a new group for C-E-I-R. Its first problem is evaluating the newest computers, data transmission systems, automatic operating systems, and scheduling work for various centers.

A new Canadian subsidiary for Burroughs, Burroughs Business Machines Ltd., brings together marketing and manufacturing.

Farrington scanner operations are being consolidated at Intelligent Machines Research Corp., a subsidiary, in Alexandria, Va.

Southern electronics will get close attention from IBM's new district with a New Orleans headquarters.

Smith-Corona Marchant, in agreement with Clary Corporation, will market the Clary DE-60 computer, a scientific and general purpose machine.

NEW USES

Mass management games were held at the RCA Electronic Data Processing Center in Chicago in March. Twenty six-man teams competed.

Univac has a Mobile Computer Center with an SS 90 and is roving the country to demonstrate doorstep customer service.

The Federal Reserve Bank of Boston began operating its NCR 304 system in March to handle the flow of checks for clearing.

The Wilmington Trust Company began its operations on a new IBM 7070 in checking, savings, commercial, and consumer loan operations in March.

The John Hancock Mutual Life Insurance Company has gone from IBM 650s to IBM 7070.

Pioneer Service & Engineering Co., of Chicago, is using an IBM 1620, the first in the utilities field.

RCA's Automatic Logging Electronic Reporting and Telemetering system (ALERT) is keeping constant vigil over widely separated petroleum wells or cross country pipelines, reporting breakdowns and relaying instructions from a central control point.

FOREIGN

Stockholm Svensk Husdjursskotsel (national Swedish cattle breeders association) has ordered an RCA 301, intended to maintain breed-line records of dairy cattle throughout Sweden.

Remington Rand International has bought two converters from Digitronics for use in Japan; these machines are designed to accommodate both English and Japanese languages.

The Ministry of Aviation has ordered an Elliott 502 computer for experimental air traffic control and training-simulators development.

Elliott-Automation announced that over 100 digital computers have been ordered (30 were delivered in 1960) and an additional 25 orders have been received already in 1961. About half of the orders were for the 803, a transistorized medium sized machine.

Philco has named ABN Industries, Inc. as exclusive sales representative for the Philco 2000 computer in Europe. ABN's parent organization is the ABN Group of Tyreso, Sweden. Large scale data processing systems will be marketed in Sweden, Norway, Denmark, Finland, West Germany, France, Holland, Belgium and Luxembourg.

Scandinavian Airlines System and Swissair have ordered Bendix Doppler Radar Navigation Systems for all aircraft.

MILITARY

The Navy is using Univac SS 80 for inventory management of some 200,000 items ($212 million dollars worth) for repair and maintenance of the fleet's electronic equipment for seeing, hearing, communications, fire ammunition and missiles.

SoundScriber Corporation has a $928,227 contract from the Federal Aviation Agency for magnetic tape recording equipment.

Bendix Corporation has $27 million in new contracts for flight control systems and air data computers for the AF B-58 Hustler.

The Defense Communications Agency, part of the Department of Defense, dedicated its center at Arlington, Va. in March. The center's system was designed around the Philco 2000 system with a communications complex by Systems Development Corporation

The Navy has ordered $5\frac{1}{2}$ million worth of Navy Tactical Data Systems from the Remington Rand Univac Military Department.

The EECO 100 computer language translator is being used by the U.S. Navy David Taylor Model Basin (Washington, D.C.) as well as by other bureaus and agencies. It is being used at the Applied Mathematics Lab., Hydromechanics Lab. and the Structural Mechanics Lab. of the Model Basin--the Navy's largest research laboratory devoted to the development and improvement of ships, aircraft and missiles by means of model testing.

Air Force Systems Command (AFSC) is the merger of the Air Research and Development Command (ARDC) and the Air Material Command (AMC), with complete responsibility for managing the acquisition of system programs from development, test and production through installation and checkout.

An RCA 501 system is being used to process as many as one million allotment and retired pay accounts a month by the Air Force Accounting and Finance Center, Denver. The Federal government through the Air Force is using a Farrington Optical Scanner to process 700,000 dependent-allotment checks a month at Denver, in conjunction with the RCA 501.

The Office of Civil and Defense Mobilization has given Remington Rand a $20,000 contract to develop an exercise that will help train federal, state, and civil defense officials through gaming.

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COVER FEATURE

Electronic Data Processing and the Office Worker

The problem of personnel displacement has been elaborated on by many writers. Here is one expert's view of how personnel in the office are affected as computer use increases.

AT THE TURN OF THE TWENTIETH CENTURY (and earlier) workers used to lament about the effects of technological change. Some sang the following song:

"Improvements on machinery take your skill and tools away,
And you'll be among the common slaves upon some fateful day."

By Albert A. Blum

The worker in the 1960's no longer fears becoming a common slave. But technological change and automation frighten him nonetheless. He worries about loss of jobs, loss of skills, loss of wages, whenever he hears such terms as UNIVAC, ALWAC, ELECOM, DATATRON, MINIAC, RAYCOM, BIZMAC, CDC, NCR, IBM 705, and learns that his company is considering the installation of some automatic data processing system. Are these fears justified or just unhappy wanderings of the workers' imaginations?

Unfortunately, as important as an answer to this question may be, we have to admit to no firm response. Research is still continuing. What will be attempted here is a posing of certain of the problems and a listing of some of the solutions that have been suggested.

One fact we do have: unemployment has been rising. There is no doubt that technological change has had some effect — this despite the numerous studies that indicate that when a company installs a data processing system, executives often promise not to drop any workers and usually do not. But others have not made the promise and have laid workers off. For example, the vast technological changes in the steel and automobile industries explain the drop in employment there. Even those companies that have made and kept the promise not

to lay off people have not been able, on the other hand, to hire new workers except to fill relatively few vacancies. The Department of Labor recently studied the installation of electronic data processing equipment in twenty offices. Only a negligible number of workers had been let go. One sixth, however, quit, retired, died, or had taken leave of absence and only a very few new employees were hired in their place. Within one year of the installation of the equipment, total employment which had numbered 2800 was down 25 percent. Another study of impact of the installation of data processing equipment in offices in nineteen firms in the San Francisco Bay area indicated that for every five jobs lost only one was gained. And this pattern is followed elsewhere. Where firms agree not to lay off their employees, as long as the worker remains at the office, the job remains; when he leaves, so does the job. One of the leading experts on automation in America, Professor Charles Killingsworth of Michigan State University, has also pointed out that there is evidence to indicate that employers wait to lay off excess workers until there is a downturn in business. Add to this the practically inexorable pressure of twenty-six million new young workers entering the labor force during the next decade looking for jobs that have been dammed up behind automated walls and we can see the extent of the problem of automation on employment. The man who is displaced, says one writer, is the one who does not get hired.

Will history repeat?

But, respond some experts, technological unemployment is only a short run problem. It may cause distress for a few for a while, but in the long run, total employment will rise. After all, reading history, the few horseshoe makers gave way to many more automobile workers. But when today's automation takes away the job of the automobile worker where does he go? The large number of unemployed workers in Detroit provide an answer to this question — nowhere. As Killingsworth has put it, the burden of unemployment may be shifted "from the man who already had a job with the company to the man who gets laid off in the next recession and never gets called back." After all, one of the purposes of automation is to increase productivity and one should not be surprised when it achieves its goals as, for example, it has in the chemical and transportation equipment industries where partially as a result of automation, production has gone up about 80 percent during the 1948-1958 period while employment of production workers has either declined or remained constant. Moreover, the National Planning Association estimates that there are now two million workers chronically unemployed, in part as a result of technological change; it estimates that this number will increase. It may be that in the long run, although many doubt it, technological unemployment will disappear. But as one economist has put it, the only thing that we can be sure of in the long run is that we will be dead.

Worker reaction

But what about the effect of electronic data processing on the workers that remain at work? Are they pleased by the change? Have their jobs been upgraded? These are a few of the questions being asked. Research findings in this area are just coming in. The installation of an IBM 650 in an insurance company resulted in most of the workers being satisfied with the installation and more of the workers liking it than disliking it. One of the reasons often given for a favorable reaction is that the workers' skills are raised. This hypothesis has been questioned lately. John Diebold, the young specialist on automation, has argued that automation will eliminate "a whole stratum of dull, repetitive, low paid jobs, both in factories and offices." James Bright, however, studied the effect of automation on thirteen plants with almost 50,000 employees and came to the conclusion that "automacity does not necessarily result in a net upgrading of work-force skill requirements to a major extent. In fact, automation often tends to reduce the skill and training required of the work force." Ida Hoos studied nineteen offices in the San Francisco Bay area and came to the same conclusion as Bright. It, therefore, appears that while some jobs have had their skill contents raised as a result of automation, many have not. Dull, repetitive jobs have often been replaced by other dull, repetitive jobs.

To sum up, the effects of technological change on employment during the industrial revolution of the nineteenth century seem to have been turned upside down during the second industrial revolution of the twentieth century. Technological change during the nineteenth century forced many workers out of jobs immediately, though in the long run probably created many new jobs. The present age of automation frequently seems to result in no immediate unemployment but appears likely to cause a great loss of jobs in the long run. One reason for this change is that in the century or more since the installation of the first looms in England society has become committed to the concept of trying to cushion the impact of technological change on its members. As a consequence of this philosophical change, there is a great deal of thought being given by members of the United States government, by executives of companies and unions, and by the individual employees themselves, to procedures that will lessen the impact of automation on the worker. Some of the suggestions that have been made are as follows: the halting of

technological change; consultation between management and labor prior to installation of automatic equipment; special study committees; guaranteed employment; expansion of seniority units; extended transfer rights; retraining; paid moving expenses; severance pay; guaranteed wages; shorter work week; and a host of proposed actions by the government.

Include personnel in plans

One way that has been suggested and frequently carried out is that management informs workers of their plans to install automated equipment and discusses with them procedures to make the adjustment as easy as possible. In the Department of Labor study mentioned earlier, most of the twenty offices "took advantage of the gradual unfolding of this major change to inform employees in advance about the change and to make explicit their policies about job security." Another Department of Labor study of an oil refinery noted that "management officials discussed the proposed [technological] changes and their effect on workers with union representatives at the refinery and worked out union contract provisions on layoff, transfer, and promotion" and as a result the changeover took place with a minimum of ill will. Of course, some companies are fearful of the impact upon morale of the workers if they learn that automated equipment is being installed. But unless one has a tight security system, the company's plans may leak out with an even greater shock to workers' morale than any joint planning and discussion could ever cause.

Related to advance notice and consultation, and particularly as a result of union negotiations, certain special study groups have been set up to handle the impact of the technological change. Kaiser Steel, Armour and Company, and the Pacific Maritime Association are examples of firms that have negotiated now famous contracts with their unions which set up special committees, in the words of the Kaiser Steel agreement with the Steelworkers in 1959, to

> "study problems resulting from automation and technological change and local working conditions, and to make recommendations to the parties with respect thereto. It is mutually understood that the parties must apply themselves conscientiously to these problems to the end of achieving continued progress . . ."

But what are the substantive things that are often sought and secured through advance notice

(continued on next page)

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and consultation and through special study committees? One of them is that no worker should be dropped as a result of technological change. Another goal is transfer rights. When a worker's job is automated out of existence, many executives have agreed to give their workers prior rights to any other jobs still available in the office — including jobs on the automated equipment. Since this often requires retraining, companies frequently accept the responsibility of providing this training. Some of them have even assumed (often working with the union) the task of training displaced workers for completely different jobs in other industries. In addition, the concept of seniority in layoffs is being expanded to include the whole company, an industry, or an area. In certain union contracts (for example, the automobile workers with Ford and General Motors in Detroit), if a worker loses his job in one plant, he may transfer to another plant in the area. In the telephone industry, where automation has been used extensively, there has been pressure for workers whose jobs have been wiped out by new equipment to be transferred to another telephone company with their moving expenses being paid by the firm. Management has not always accepted this concept. Professor William Faunce of Michigan State University studied the impact of automation in an automobile company (and the reaction of production management may not be different from office management's reactions). He discovered that:

> "Job transfers were discouraged by management in this plant because familiarity with the particular operations on each machine was regarded as more important since mistakes were more costly. The broad seniority units in the plant which facilitated transfers were regarded as a particularly difficult problem by management for this reason. It is the feeling of management generally in the automobile industry that seniority units should be narrowed . . .
>
> It is the union's contention, however, that seniority units should be broadened. Because automation does not affect all departments or plants equally, it is argued that seniority units should be broadened to protect jobs of high seniority workers in the automated departments or plants."

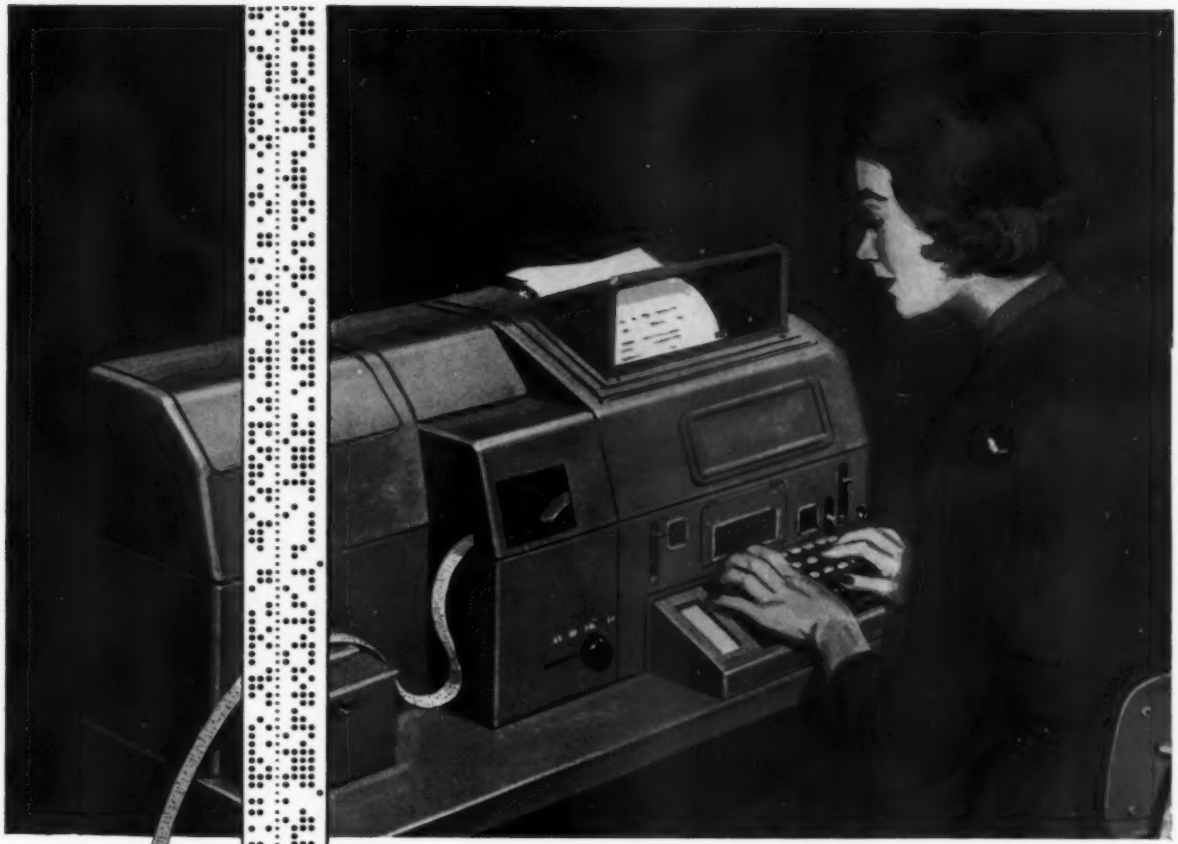
A related problem is that of offices with new electronic data processing machines installed. What is the firm to do with the workers involved in the old offices? If the installation is approximately at the same location, workers usually can transfer without hardship. But if the new unit is at a great distance from the old, the problem of transfer rights arises. Some companies have paid moving expenses for those who want to change to the new location. Others have paid severance pay. Still others have done nothing. There is growing pressure on companies that have unions to provide for relocation expenses — and surely to provide for severance pay.

Although pay has barely been mentioned up to now, surely one of the fears of workers is that automation and office machines will result in some of them being paid less — because of a loss of skills or because of fewer hours worked. Many executives attempt to allay this fear by promising that there will be no reduction of wages as a result of the installation of automated equipment. Unions have been trying, unsuccessfully, for a guaranteed annual wage to insure against a reduction of pay. They have accepted supplementary unemployment benefits (or unemployment pay in addition to that given by the state) as a hedge against the impact of technological unemployment. They are now striving for a shorter work week which has as one of its goals the spreading out of work without a reduction in wages.

Everyone's concern

These are some of the suggestions for lessening the impact of automation that have been suggested by workers (either through unions or by themselves) or by management. But the government has also expressed its concern. Proposals to alleviate the conditions in distressed areas, suggestions for early retirement of workers, various studies just started by the Secretary of Labor on the impact of automation, and the formation of the top level President's Advisory Committee on Labor-Management Policy are just a few indications that public policy will also be felt in this field. Moreover, the government, through fiscal and monetary programs, along with other public and private groups is attempting to increase the total number of jobs available for the laid-off worker or for the new entrant in the labor market.

In the nineteenth century, when public leaders, businessmen, and economists were faced with harsh conditions in the factory and by unemployment caused by industrial change, many responded that these conditions were inevitable. It was no wonder that the group of economists who so argued have been labeled as the dismal school of economics. In the twentieth century, faced again with the problem of great unemployment caused by technological change, business and labor leaders, public officials, and economists no longer surrender to its inevitability but seek answers. Those who make the data processing equipment must also, and many have already done so, join in this exciting search for answers to the problem of technological unemployment. ■



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AVOIDING PERSONNEL DISPLACEMENT

First in a series of case studies giving positive solutions to the "PD problem"

The Human Element

A long range view of the general labor market.

AS WE at Detroit Edison look back over our experiences, we feel the human element in data processing is the most important. At our company, there were 800 employees in accounting and 1,500 in the sales divisions who would be either directly or indirectly affected by the introduction of our first 705. These people, in offices spaced about southeastern Michigan, had to be regrouped differently and would eventually number considerably fewer. The company felt that it was absolutely essential that these employees be given some security in the change. This we could do because we felt we had a large reservoir of employee good will developed through fairness and honesty in employee relations for a long period prior to the change. Employees trusted management, and management returned the trust by assuring employment and wage security during and after transition.

Other policies were established for the transition: all promotions associated with the change were made temporary; new employees were hired temporarily.

During the year and a half of the conversion it was necessary to maintain three organizations, one to operate the old system, one for the new system, and a third to do the actual conversion. Employees were shifted and selected on the basis of their experience and ability for the temporary jobs that were to be done; additional help was borrowed from other departments and new temporary help employed where necessary.

All supervisors had been trained in human relations and the advantages of communications through group meetings and careful reporting. These skills were used to keep employees and management informed on progress.

Our greatest difficulty came in the area of cus-

By Franklin C. VandenBosch

tomer relations because customer complaints increased during the initial stages of conversion. Action was taken to offset complaints through establishment of an information program in which all directly affected personnel were made aware of the complexities involved and progress made. Opportunity was provided for exchanging views and problems.

Conversion to the computer was followed by conversion of bill printing to a new laminated bill printed on high speed printers. This job eliminated sixteen electric accounting machine operators. With this phase completed, a permanent organization took shape. New job descriptions, requirements and grades were set up within the company's regular job grading system. Keeping in mind previous commitments, people were selected and trained for permanent positions.

It became apparent that the expected upgrading for jobs did not materialize except in the programmer area. Jobs were found for all permanent employees and most of the temporary ones. Training became a major task for supervisors as people shifted from one job to another.

The computer installation affected these levels:

Top management

In the initial feasibility study top management decided on a *system* approach rather than a hardware approach. This meant an open door for the review of every facet of customer record keeping, including all contacts with customers, and also some consideration of all machine accounting operations. The only restrictions were that good customer and employee relations be maintained and the computer pay its own way. Some managerial responsibilities were changed and the focus of top management fell on the accounting and sales areas.

Departmental management

While departments initiated many organizational changes and other efficiencies as computer operations progressed, many of these could have been made without the computer.

The work load on department directors rose sharply. Delegation of responsibilities became imperative. Selection of temporary supervisors to head conversion groups brought the need to use good selection techniques and offered a chance to look over, test and try people for supervisory capacity.

Good communications had to be developed to keep supervisors and employees informed on operations. At the same time, proper emphasis had to be given to broad company projects such as work simplification, employee proposals, reduction of absenteeism, maintenance and development of work standards.

First line supervisors

The first line supervisor was in the middle during the change. Familiar operations suddenly changed, and the new methods required much study and technical skills in addition to good human relations and management skills formerly relied upon.

An extensive training plan was necessary for the constantly shifting personnel. Morale had to be maintained among those operating the old system which they knew would soon end. Old employees had to be taught new skills some would rather not bother about; and some supervisors found it difficult to keep up with their subordinates in learning the new techniques.

During conversion the supervisor was too busy to worry about his own security. Afterwards, he went through the selection phase for the permanent organization. Some supervisors did not have the necessary technical skills and other jobs had to be found for them.

The supervisor in the permanent organization passed through another trying period as he helped select and train his permanent work force. Some of these were marginal workers assigned him because they did not fit in elsewhere, and among these were both those who made something less than a completely satisfactory adjustment, and those who adjusted beyond expectations.

The employee

The non-supervisory employee had his problems. Before conversion, employees were informed of the general plan and assured job security. Older employees at first had doubts of their own ability to handle the more complicated system. Once conversion began there was little time to worry. Hard work and long hours were involved in the struggle to keep up with changes. Many came up with good improvement ideas for both work routines and operating conditions.

Although most employees took a good constructive approach to new assignments, results varied widely. Basic aptitudes began to show up as equal in importance with attitudes. Employees without these aptitudes found it difficult to adjust to new skills and procedures.

Noting this, management increased its use of aptitude testing as a tool in improved selection of new employees and assignments and promotions. The use of this tool has been most successful in selecting key punch operators. An operator with high aptitudes can do double the work of one with average aptitudes, or triple production of one with poor aptitudes.

Employee reaction to testing varied. Those who tested well and were selected reacted favorably and gained self confidence. Among those not pass-

ing the test, feeling ranged from relief at not getting an unsuitable job to assuming that this restricted future promotion. These people did not like the testing, and felt that too much emphasis was put on it.

New problems for the employees arose during permanent organization following the conversion. Since the average grade of jobs outside of programming did not rise, most people found themselves on jobs at the same level as before conversion. A number of them had held high grade temporary jobs. Some of these and others who had to be placed on lower grade jobs found it difficult to adjust to the situation. Naturally, they are not happy with their lot. A list of these downgraded employees is kept and every effort is made to retrain and place them on jobs at their former grade as the opportunity occurs. This list is gradually getting smaller and we hope to eliminate it some day.

Most of the reductions were made in clerical groups, and most of these were women. Natural attrition, such as departures to raise families, retirement at 65, a few early retirements, and departures to enter military service, provided opportunities for gradual reduction. A few transferred to higher level jobs in departments outside this area. Nobody was laid off except for one marginal temporary worker.

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The future

Things are not standing still. Our first conversion to the 705 had us processing all of revenue accounting, payroll, and some plant accounting and a few related jobs. We are replacing all the machines now with a 705 III, a 1401 C system, and two 1401 D systems. This will reduce elapsed time and labor cost on present work, and give us at least five years' expansion capacity.

We have an optical character scanning device on order which will be available within a year. We will eliminate 25 or 30 per cent (about 20) of our keypunch operators by using this device on our cash coupons.

Looking ahead for about five years, we do expect a further reduction in clerical help, but not as large as previously. *The people saved will probably be the ones not hired* because of our ability to absorb additional work arising from normal company growth.

The same pattern is likely to be followed by most companies. The first installation of automatic equipment is frequently justified by the replacement of quite a large number of people on a single high volume job. Subsequent applications provide better and more timely data for management and reduce personnel sufficiently to offset normal growth factors.

Although this has only been true in fairly large companies, it will very soon take place in medium sized companies and even comparatively small firms.

Clerical outlook

As electronic data processing develops, we see a spreading pattern of the substitution of machines for clerical workers. We don't see many being laid off, but it would appear that not as many would be hired; the total number would become less and less, and opportunities for the office worker would be curtailed.

However, to brighten the clerical picture, the demand for workers has outdistanced the supply, and the machines have taken over to fill the gap.

As we look ahead, we see increasing demands on the clerical worker. He is gradually changing into a technician or specialist.

Also, the clerical worker will have to become more versatile. Changing equipment and methods will alter operations and his job much oftener than they have in the past. The office machine worker will be at the center of these developments and gradually a higher caliber of man is going to be needed in this field. To supervisors and management, I would like to say that now is not too soon to start looking for and developing people with high aptitudes and initiative. They will be necessary for your success in the times just ahead. ■

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DeParis on EQUIPMENT —A Monthly Feature

New Punched Card Equipment

JOSEPH R. DE PARIS

This is the concluding article in a two-part series, the first of which appeared in last month's issue.

THE IMPORTANCE of the position in data processing of punched card equipment is demonstrated by the fact that equipment manufacturers continue developing devices and attachments which add to the flexibility and power of such equipment. Last month we discussed the SEMA-2000, an electronic memory attachment for punched card machines. This month we continue with a discussion of other interesting and useful devices in the punched card area.

Management Assistance, Inc. of New York has developed the WROC-452, a special purpose data processing device designed to connect with and expand the capabilities of machines in the IBM 400 and 500 series. The WROC (pronounced rock) is intended to increase significantly the selector capacity of punched card equipment and to provide additional operating functions while bringing about savings in time and costs.

The WROC has its own control panel and is connected to the equipment by way of a summary cable. In addition to its own cable, the WROC has a cable receptacle which permits the WROC to be connected to a tabulating machine, and another machine, such as a summary punch, to be connected to the WROC. The hardware offers a powerful increase in the selector capacity of regular electric accounting machine equipment. There are up to 48 five-position co-selectors, a 100 position two-column digit selector, and up to eight ten-position selectors that can be transferred at 10 different levels. In addition, there are up to five digit selectors, a half-after emitter, a character emitter, and a coincidence unit of up to 16 positions which gives a comparison on equal impulses. The WROC features a display console which visually indicates the internal selector conditions.

The main functions of the WROC lie in its ability to store predetermined information which can eliminate certain information from master cards and eliminate secondary master cards entirely. The machine can generate customized reports on stock paper, thus reducing form costs. It can reduce processing time by eliminating some detail cards as well as some auxiliary machine steps. By its ability to emit and decode data, the WROC has the effect of reducing the need for card columns; hence, it reduces gangpunching and keypunching operations.

Uses

Here are some examples of how the WROC may be employed:

a. With a 519, explosive type reproducing usually done on a 528 may be accomplished. In this application a variable number of cards may be reproduced while emitting information. In addition, trailer cards may be generated from codes in master cards.

b. With a 402/3 or 407, WROC provides the ability to 1) control an account number that includes special symbols (e.g. government specifications), 2) build a self-editing system, even to identifying the reason for a break in edit, 3) emit from 570 to over 1000 alpha characters by control punches in the cards, 4) generate trailer card information from codes in the lead cards. In addition, on a 407, WROC enables summarization of up to 64 alpha positions.

c. With a 419, the WROC permits the summarization of alphabetic information.

A specific example of the WROC in action is the situation in which a summary report is to be run with account major and class minor. Class descriptions, which appear repetitively in each account group, must be shown. Such a problem may be solved by connecting a WROC-452 to a 407 and 519. With detail cards in order by class within account, only three machine steps are required:

1. Cut summary cards containing WROC induced alphabetic class descriptions.
2. Merge account name cards with summaries.
3. Print report on 407.

The usual approach without a WROC would entail seven machine steps:

1. Cut summary cards without alphabetic class description.
2. Sort summaries to class code order.
3. Merge with class masters.
4. Gang punch class description.
5. Sort back to account sequence.
6. Merge account name cards with summaries.
7. Print report on 407.

In terms of time, the folks at Management Assistance estimate that steps 2 through 5 add about three hours to the job on a volume of 5,000 cards, 21 hours on a volume of 35,000 cards. These are hours that would be saved by the WROC-452.

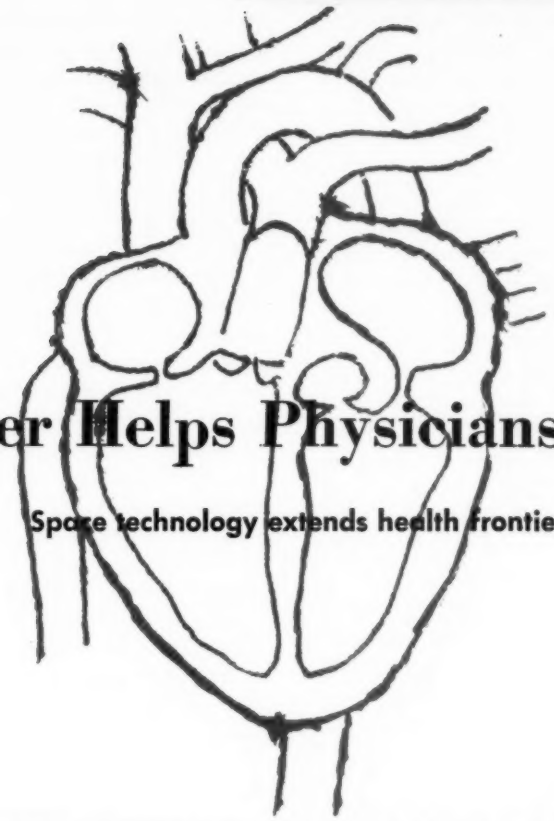
The WROC-452 has been in operation for over two years and rents from $210 to $450 per month.

Other improvements

Let's take a look now at some other improvements to punched card processing. For one, Monroe has developed a card punch verifier which is an attachment to an IBM 024 or 026 keypunch. Called the Synchro-Monroe Card Punch Verifier, this is an adding machine which sits on the key punch table and is actuated by the same program card that controls the punching operation. As the operator punches, the Monroe verifier adds (or subtracts) the

(continued on page 49)

APPLICATION OF THE MONTH



Computer Helps Physicians Diagnose

Space technology extends health frontiers.

YOU MAY NEVER GO TO THE MOON, but there's a good chance you may one day have personal reason to thank your lucky stars this nation is spending millions to conquer space.

This research could save your life — not from mysterious enemies from outer space but from today's common-place horrors like heart disease and mental crackup.

Thanks to a happy overlapping of interests, space scientists and medical men even now are jointly engaged in serious research that could lead to faster, more accurate diagnosis and treatment for common health threats.

Consider what is happening at Lockheed Aircraft's huge Missiles and Space Division at Sunnyvale, California. The Division is contributing time on a big IBM 7090 data processing system and other electronic equipment, as well as the services and know-how of scientific personnel, to a nationwide study aimed at the nation's number one killer — heart disease.

Under the general sponsorship of the Heart Research Foundation of Los Angeles, California, doctors of this foundation across the country will take pressure wave readings periodically from 1,000 patients, some of them known victims of heart or vascular disease. Lockheed's computer will analyze these readings as it analyzes problems in aerodynamics — hopefully telling the doctors more about each patient's disease than has ever been available before.

Mr. E. K. Fisher, Manager of the Data Processing Division at Lockheed, and Dr. Travis Windsor of the University of Southern California's Departments of Medicine and Director of the Heart Research Foundation, already have established a revolutionary technique for relaying heart data to Lockheed's advance computing center here. The experience gained from this study will be used to help establish a major medical computer center at the University of Southern California.

With special Lockheed-developed equipment, electrocardiogram and pressure wave results for each patient are recorded on magnetic tape in the form of audible FM signals. Using a standard FM modulator, these signals are then "telephoned" long distance from Los Angeles to Sunnydale where they are re-recorded.

Data analysis

Data thus received is electronically converted from FM form to digital signals on tape acceptable to the computer. The computer then analyzes in detail the data taken from each patient. The

analysis is plotted on a chart which is sent back to the physician in charge. At the same time, all computed information is stored on a special magnetic tape record for each patient. On short notice, the computer can, at any time, spell out the complete cumulative to-date history for any or all of the patients participating in the study.

This is significant because doctors will be administering different new drug types to the patients. The ability to recall and analyze cumulative data will make it possible for a doctor to "see" at a glance how each disease has reacted to each drug over a period of time. Abbott Laboratories have made a substantial contribution in the form of necessary drugs to the project.

It took Lockheed's George Hubbard two years just to develop the complex computer program which instructs the fast-figuring machine how to process the medical data as it is received. The program is so complex, in fact, that only a few computers in the country have the capacity and speed to accommodate it.

The more information fed into it, the more valuable the computer's data becomes. It will categorize the ways in which pressure wave readings and electrocardiogram results vary from normal, placing them in groups by type of disorder. Whenever readings are taken from new patients with heart trouble, the 7090 will be able, by correlation and comparison, to "fit" the patient into the proper "trouble category." This, in effect, is diagnosis.

It is the same thing a doctor does mentally when he looks at an electrocardiogram. The big difference is that each doctor must interpret what he sees in terms of existing medical knowledge and his own experience. Different doctors look at the same results, and come up with different ideas as to what is wrong and what should be done about it.

Computer diagnosis

In the Lockheed-Heart Research Foundation experiment, the computer will take over much of this chore. But it will do its selecting and diagnosing on a much broader base — in fact, on the basis of a giant memory loaded with carefully-compiled historical data.

Eventually, Hubbard believes that Lockheed and the medical men will mathematically work out computer techniques that will assure a high degree of accuracy in diagnosis.

Later, the computer could be programmed to do more than diagnosis. When fed similar statistics on the effectiveness of different types of treatments, it could spell out the recommended treatment for a given disorder *on the base of statistics.*

E. K. Fisher, Lockheed's Information Processing Manager, emphasizes that the computer will not be taking over the physician's work. "It simply will provide him with much better knowledge faster," he says.

The IBM 7090 computer used by Lockheed is among the most sophisticated at work in space studies today. It can perform 208,000 additions or subtractions or 20,800 to 208,000 multiplications or 20,800 divisions a second. Its magnetic core memory unit, in which instructions and statistics are electronically stored for future use, has a capacity of 327,680 digits. It can read, write and calculate simultaneously.

All of this means that the 7090 can go through the mathematics and make the correlations and comparisons necessary to make a diagnosis in seconds.

The planners foresee the day when several hospitals will be hooked into a medical computing center. Doctors can "phone" readings to a computer and get an analysis back quickly. With more knowledge and computer capacity, this might be expanded to cover the whole human body — not just the heart.

Already Lockheed and Dr. Lawrence Stark, associate professor of neurology at Yale University School of Medicine, are comparing notes. Dr. Stark hopes the computer techniques used in the heart study may also be applicable to the analyses of electroencephalogram results, a problem on which he is conducting research. Electroencephalogram readings measure brain waves by electrodes planted inside patients' scalps.

Lockheed also participated with Dr. Windsor in a study which resulted in refined techniques for measuring peripheral circulation in patients afflicted with hardening of the arteries. The significance, as reported in a certain medical journal, shows an improved method of detecting a circulation blockage as it is formed. This makes it possible to attack the blockage with drugs in its beginning stages with the hope of preventing the need for surgery. It also makes it possible to determine more accurately the effects of the drugs on patients.

Lockheed first became interested in medical research from a humanitarian point of view, but what began as an altruistic contribution of company funds has become vitally intertwined with the company's own future in space.

Space flight and environment

The Missiles and Space Division currently is conducting the Discoverer satellite program for the Advance Research Agency. Success in this project to date almost assures Lockheed a front-running position in this country's continuing space effort.

Electronically, the company has made significant headway in retrieving data from its space vehicles. As Fisher describes it, Lockheed scientists have a

pretty good idea about what is happening to their satellites while aloft.

But how the phenomena of space flight and space environment will affect man is still largely a question mark. Man is not made so that he can communicate a digital signal to a computer saying, "My blood pressure has just gone up two points and my heart is skipping one beat every 2½ minutes."

So how do you learn how man and his component parts are reacting to his environment, whether in space or on earth?

Lockheed scientists are not satisfied with the available answers to such questions. They believe that by applying the knowledge of electronics gained from work with missiles, they can develop improved reporting techniques to better inform doctors what goes on inside a man's body.

The programs outlined here are a start in this direction. Other research may well be directed at improving common methods now used to measure blood pressure, heart functions, mental processes, and so on down the list.

About the best a man can do in describing his own physical problems is in the words, "I don't feel so good, Doc."

This is not good enough for space scientists, Fisher explains. "If you have a man piloting a space vehicle, you can't depend on him to keep you fully informed. If he's cracking up, mentally or physically, you've got to be tipped off immediately and over-ride him at the controls. Otherwise, you've lost him." ■

Coming Events

JUNE 18 - 23

Business Management Institute, Electronic Representative Association.
University of Illinois Campus, Champaign, Ill.

JUNE 26 - 28

IRE Fifth National Convention on Military Electronics.
Shoreham Hotel, Washington, D. C.
Contact: Mr. Harry Davis, SAFRD, Pentagon, Washington 25, D. C.

JUNE 28 - 30

NMAA Annual Conference.
Royal York Hotel, Toronto, Canada.
Contact: Mr. R. Calvin Elliott, Exec. Dir. NMAA, 1750 W. Central Road, Mt. Prospect, Ill.

JUNE 28 - 30

ISA, AIChE, AIEE, ASME and IRE
Second Joint Automatic Control Conference.
University of Colorado Campus, Boulder, Colo.
Contact: J. L. Harned, Research Laboratory, General Motors Corporation, Warren, Mich.

JULY 16 - 22

ISA and IRE 4th International Conference on Bio-Medical Electronics and 14th Conference on Electronic Techniques in Medicine and Biology.
Waldorf-Astoria Hotel, New York, N. Y.
Contact: Dr. R. L. Bowman, ISA, Dept. of Health, Education and Welfare, National Institutes of Health, Bethesda 14, Md. or Dr. Herman P. Schwan, IRE, Univ. of Pa. School of Elect. Eng., Philadelphia, Pa.

JULY 18 - 20

Western Plant Maintenance and Engineering Show and Conference.
Pan Pacific Auditorium, Los Angeles, Calif.
Contact: R. L. Saling, Ch. Bd. of Sponsors, c/o Clapp & Poliak, 759 Monadnock Bldg., San Francisco 5, Calif.

AUG. 10 - 12

Bendix G-15 and G-20 Users Exchange Conference.
Denver Hilton, Denver, Colo.
Contact: Mary Jane McPhee, Bendix Computer Division, The Bendix Corporation, Los Angeles 45, Calif.

AUG. 22 - 25

WESCON, Western Electronic Show and Convention. IRE/7th Region and Western Electronic Manufacturers Association.
Cow Palace, San Francisco, Calif.
Contact: E. W. Herold, c/o WESCON, No. California Office, 701 Welch Rd., Palo Alto, Calif.

AUG. 23 - 26

Institute of Management Sciences, 8th International Meeting.
Palais de Congres, Brussels, Belgium.
Contact: I. M. S., Box 273, Pleasantville, N. Y.

AUG. 28 - 30

American Accounting Association Convention.
Austin, Texas.

SEPT. 5 - 8

Association for Computing Machinery, 16th National Conference and 1st International Data Processing Exhibition.
Statler Hilton Hotel, Los Angeles, Calif.
Contact: Ben F. Handy, Jr. General Chairman, Litton Systems, 5500 Canoga Ave., Woodland Hills, Calif.

SEPT. 6 - 8

IRE International Symposium on Transmission and Processing of Information.
Massachusetts Institute of Technology, Cambridge, Mass.
Contact: Peter Elias, MIT, Room 26-347, Cambridge 39, Mass.

SEPT. 11 - 15

Fall Instrumentation-Automation Conference, ISA 16th Annual Meeting and Exhibit. Memorial Sports Arena, Los Angeles, Calif.
Contact: Wm. H. Kushnick, Exec. Dir., ISA, 313 Sixth Ave., Pittsburgh 22, Pa.

SEPT. 11 - 15

SHARE Computer User's Conference, IBM 701, 704, 709 and 7090.
Washington, D. C.
Contact: Mr. S. S. Closman, IBM Data Processing Div., 112 E. Post Rd., White Plains, N. Y.

(continued on next page)

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(Continued from preceding page)

SEPT. 18 - 23
Electronic Representative Association, Business Management Institute.
University of Illinois Campus, Champaign, Ill.

SEPT. 20 - 21
IRE, PGIE, AIEE and ISA Industrial Electronics Symposium.
Bradford Hotel, Boston, Mass.
Contact: Ronald A. Jurgen, Sutton Publishing Co., 172 So. Broadway, White Plains, N. Y.

SEPT. 25 - 27
Life Office Management Association Annual Conference.
Shoreham Hotel, Washington, D. C.

SEPT. 28 - 29
American Production and Inventory Control Society 4th Annual National Conference and Exhibit.
Pick-Congress Hotel, Chicago, Ill.
Contact: APICS, 330 S. Wells St., Chicago 6, Ill.

OCT. 2 - 4
IRE 7th National Communications Symposium.
Utica, N. Y.
Contact: R. K. Walker, 34 Balton Rd., New Hartford, N. Y.

OCT. 2 - 4
IRE Canadian Electronics Conference.
Automotive Bldg., Exhibition Park, Toronto, Canada.
Contact: A. R. Low, c/o Canadian Electronics Conference, 1819 Yonge St., Toronto, Ontario, Canada.

OCT. 4 - 12
Electronic Computer Exhibition.
London, England.

OCT. 8 - 11
Systems and Procedures Association 14th Annual and International Systems Meeting.
Statler-Hilton Hotel, Cleveland, O.
Contact: Mr. Lawrence E. Melick, Sec. 1961 ISM, c/o Bailey Meter Co., 1050 Ivanhoe Road, Cleveland 10, O.

OCT. 9 - 11
NOMA National Office Exposition.
Philadelphia, Pa.

OCT. 9 - 11
IRE, AIEE National Electronics Conference.
International Amphitheatre, Chicago, Ill.
Contact: Dr. William L. Firestone, Motorola Inc., Chicago, Ill.

OCT. 12 - 13
NMAA 3rd Annual Division 5 Conference.
Marott Hotel, Indianapolis, Ind.
Contact: NMAA Conference, P.O. Box 256, Indianapolis 4, Ind.

OCT. 16 - 17
PGEWS National Symposium on Engineering Writing and Speech.
Kellogg Center for Con. Education, Michigan State University, East Lansing, Mich.
Contact: J. D. Chapline, Philco Corporation, 3900 Welsh Rd., Willow Grove, Pa.

OCT. 23 - 26
National Business Forms Associates Convention.
The Americana Hotel, Bal Harbour, Fla.

Automatic Parallel Processing

Utilizing all components is good economy.

AUTOMATIC PARALLEL PROCESSING is the principal reason why Honeywell 800 electronic data processing systems are being ordered. Careful evaluation of this concept is showing prospective purchasers of data processing equipment the road to important economies. Frequently they find that big electronic data processing work loads can be handled for 50 per cent less than is possible without parallel processing.

By Samuel D. Harper

Automatic parallel processing saves money because it enables the costly high speed electronic computer to be used more efficiently than heretofore. Just as the gear box improves the efficiency of an automobile operating on different gradients, so parallel processing improves the efficiency of the computer when operating on different programs.

The principles of automatic parallel processing are very simple. It is not necessary to be a computer engineer or programmer to understand how it works.

An electronic data processing installation consists of two classes of equipment: input-output devices and a central processor. In a typical installation, the rental of the input-output equipment is likely to be no less than that of the central processor. For the purpose of illustration, we can make the reasonable assumption that they are equal, each contributing one half of the total rental.

Two phases of program

An electronic data processing program consists of two phases: the input-output phase and the computational phase. Although input-output and computation often alternate many times during a

program, it is possible to talk of the total duration of the input-output phase and the total duration of the computational phase. The ratio of duration of these two phases varies widely from program to program. Let us consider a program in which the ratio is 1:1.

It is obvious that during the input-output phase of such a program, the central processor will be working at very low efficiency, practically zero. On the other hand, during the computational phase, the input-output equipment will be working at zero efficiency while the central processor is occupied 100 per cent.

In such a system as this, the best we can hope to get is an average efficiency of 50 per cent.

Now imagine that we have a second program available, independent of the first, but having a similar ratio of input-output to computational requirements. If we can arrange to run both these programs simultaneously, doing the computation on one program while doing input and output operations on the other program, then all the equipment is in use all the time and we can expect to get an efficiency close to 100 per cent.

In this simple example, the cost of processing these jobs has been halved by the simultaneous operation of two programs.

Program with 3:1 ratio

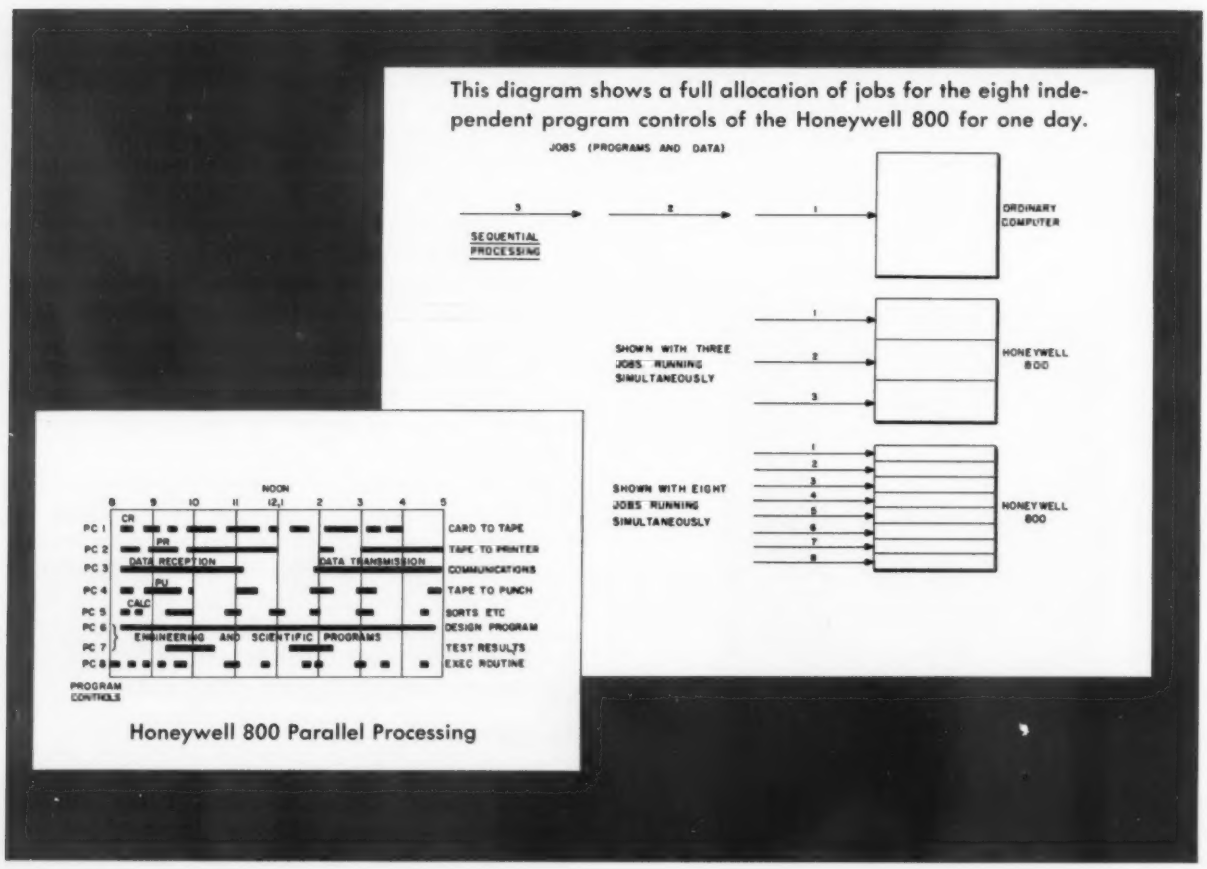
More typically, the input-output phase of business programs considerably exceeds the computational phase. The nature of electronic devices gives central processors great speed. The Honeywell 800, for example, will process 1.67 million characters (*numbers and letters*) per second. On the other hand, the speed of input and output equipment is limited by the handling of the physical documents, used by humans, to about one thousand characters per second.

To illustrate how this affects efficiency, we will now consider programs in which the ratio of input-output to computation is 3:1. In these circumstances, two programs do not obtain the best results. Clearly, the input-output equipment would be operated 100 per cent, but the central processor would only be performing 33 per cent of the work it is capable of doing.

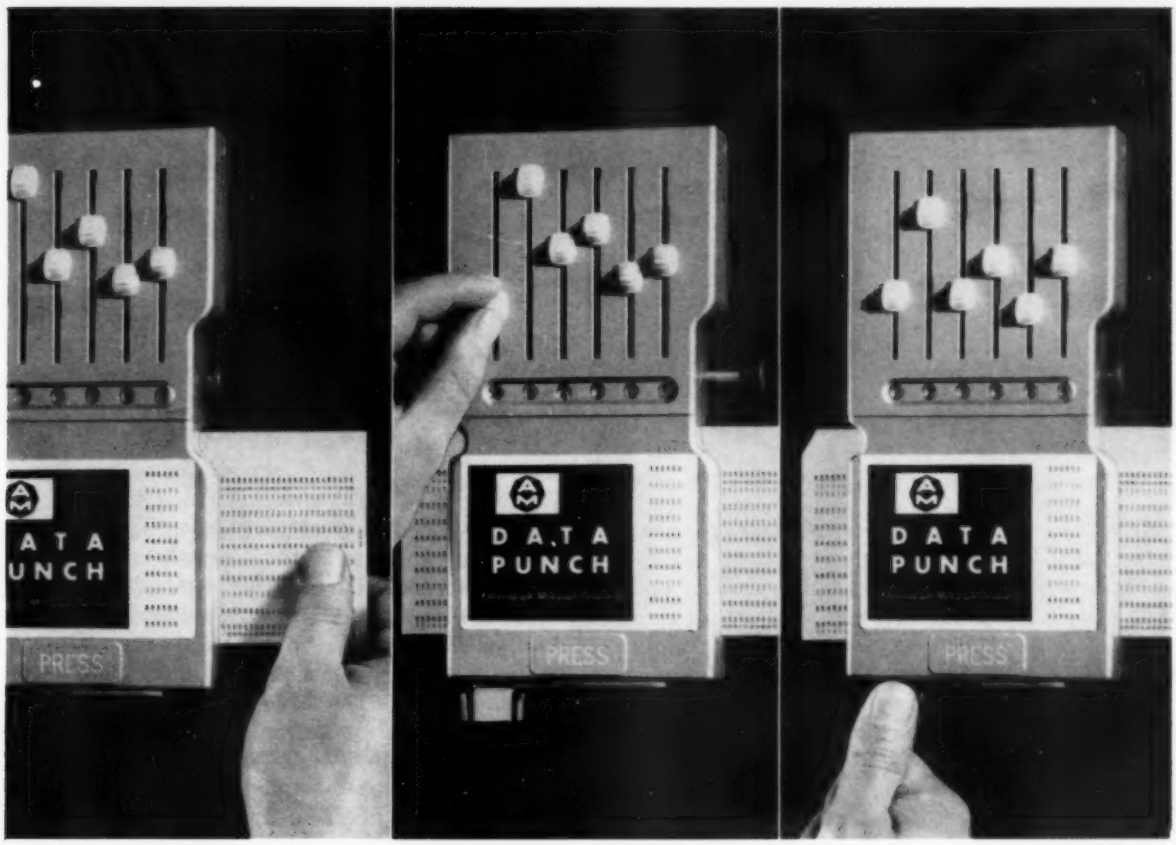
To rectify this situation, it is necessary to provide the system with several input trunks and output trunks all capable of simultaneous operation. The Honeywell 800, for example, has capacity for up to 16 trunks.

Theoretically, the provision of multiple input-

(continued on page 29)



NEW ADDRESSOGRAPH DATA PUNCH



1. Place tabulating card — or multiple part set — in machine. Select area to be punched by means of field indexing gauge.

2. Enter variable data to be punched and printed by positioning keys. Digits visible on dials for quick pre-verification.

3. Press operating lever lightly to punch and print. Lock key assures precise punch registration. No power required!

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Here is the first truly portable Data Punch . . . that gives you an accurate, low-cost way of collecting variable data from multiple, decentralized sources.

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Computer Conversion Program

Punched card conversion of 1401 programs

According to the Computer Census published in the April issue of this magazine, there are now 4,000 or more 1401 systems on order, most of them to be installed within about a year. With so many people planning for a new system, the pre-installation problems are (to say the least) widespread. The massive programming and pre-testing effort now being carried out by thousands of 1401 programmers far surpasses any similar activity yet seen in the brief history of electronic computers.

For this reason, we feel that the following article by Mr. Kraft should be of interest to many of our readers.

The Editor

By Ernest S. Kraft

THE CONVERSION and assembly of 1401 computer programs, written in Symbolic Programming System (SPS) language, to object programs in machine language, is normally done using a 1401. Several 1401 conversion programs have been written for this purpose. A company preparing its programs prior to delivery of its 1401 system, therefore, will use a service bureau computer for both conversion and testing.

Each customer is granted a certain number of hours of free pre-installation test time. Whether or not the free time is sufficient to complete assembly and test depends on the number of programs a company intends to develop before its 1401 is delivered. If the number of programs is greater than can be assembled and tested within the allotted free computer time, additional time has to be purchased.

In such a case, an assembly and conversion method using only conventional punched card machines will tend to reduce the total 1401 time required, and the related cost. Such a method has been developed at Philips Electronics Industries, where we expect to write, assemble, and test 120 programs before our 1401 is delivered.

Philips Electronics Industries, Ltd. is the Canadian subsidiary of the world wide concern headed by N. V. Philips Gloeilampenfabrieken of Eindhoven, Holland. The total number of employees in the world organization exceeds 200,000. The Canadian company, which has in the neighborhood of 2000 employees, is engaged in the manufacture and marketing of radio and television receivers, high fidelity equipment, tape recorders, dictating and other sound equipment, electric shavers and other small appliances, electronic tubes including picture tubes, automatic pinsetting machines for

bowling alleys, and a variety of telecommunications, industrial and medical equipment.

The data processing department is equipped with a 607 calculator, three 407 tabulators, and a number of peripheral machines, handling over 150 data processing applications, covering such areas as accounting, payrolls, billing, sales statistics, finished stock control, and production material planning.

The delivery of a 1401 system with tapes is scheduled for the spring of 1962 to process most of the existing applications and to permit extension of the automation of administrative functions.

Principal steps in assembly

The program used by the 1401 to convert and assemble SPS programs accomplishes these steps:

1. Test that all operation codes are valid.
2. Assign core storage locations to all instructions, constants, etc.
3. Replace labels and asterisks in the operands with the proper addresses, considering character adjustment where indicated.
4. Convert the four-digit symbolic addresses into three-digit machine codes, and apply zone punches for index register indication.
5. Punch the assembled instruction and the load instruction into the card, with special treatment of ORG—, END—, EX—, DC—, DSA—, and comment cards.

Using punched card machines

Obviously, extensive manual handling is necessary to do a computer job on regular punched card machines. In our attempt, certain limitations have been established to eliminate some manual steps. The most notable of these is the necessity for writing the programs with machine language operation codes. Machines required for the procedure are a keypunch, verifier, reproducer (with emitter), collator, and calculator. The procedure involves up to twenty-four steps and generates quite a few groups of cards, so careful card control checks must be carried out to avoid duplication or missing cards. On the plus side, any manageable number of SPS programs may be assembled simultaneously with the procedure used at Philips.

A company with a limited number of SPS programs to convert and test will find it easier to utilize the free 1401 time provided for this purpose. In our case at Philips Electronics, though, we were sure we would be unable to convert and test all our 120 programs without purchasing additional 1401 time. Our punched card equipment is here and available, and we believe the practice of converting our programs with this equipment — thus allowing us to devote 100% of our pre-installation 1401 time to testing and debugging — will save us both time and money. ■

AUTOMATIC PARALLEL PROCESSING

(continued from page 26)

output trunks in this way solves the problem of "balancing" the system. In practice, however, most individual programs do not readily lend themselves to multi-trunk operation and it is generally necessary to combine several programs to produce a multiple trunk operation for the system.

In the Honeywell 800, provision is made to allow up to eight independent programs to be operating at the same time. For the reasons outlined above, the simultaneous operation of programs can be a far better match for the capacity of the system than can the individual programs taken alone.

Executive routine

A special program called the Executive Routine assists the job scheduler to arrange the day's work in the most efficient way. After this, the programs proceed automatically, sometimes singly and sometimes in two's and three's and more, depending on the size of the system and on the requirements of the individual programs. If only one program is applied to the machine, the whole power of the Honeywell 800 is available, but if the speed of the program is limited by use of magnetic tapes or input-output devices, then only part of the computing power available is being used. With automatic parallel processing, the scheduler can run other programs along with the first until the total demands of the several programs fill the capacity of the central processor.

The scheduler who can arrange to combine a number of input-output-limited programs with a computer-limited program, will attain close to 100 per cent efficiency on the entire installation. Computer-limited programs are commonly met in engineering design and research. It is reasonable to suggest that a little careful planning can result in twice as much work done as would be possible without parallel processing. The availability of eight independent program controls encourages the running of short, simple programs. It also encourages the connection of relatively slow input-output equipment, for slow programs are only uneconomical when run alone.

Automatic parallel processing not only uses the electronic data processing equipment more efficiently while it is running, but keeps it running productively all the time. The programs are operated quite independently and when a program comes to the end and stops, the other programs continue uninterupted while a new program is automatically loaded and started.

The Honeywell 800 is the only delivered electronic data processing system which is capable of running assorted selections of programs in this highly advantageous way. ■

New ideas in punched

How your IBM supplies specialist helps you find ways to cut your punched card costs

How can a redesigned punched card improve your data processing efficiency?

Your IBM supplies specialist can tell you...and show you ways to redesign your cards to give you new data processing economies.

Your IBM supplies specialist is a man with extensive training in data processing supplies. That's why he is uniquely qualified to help you match the punched card to the job that you want to do.

There's virtually no limit to the practical cost-saving ideas he offers you for:

SAMPLE CARD SELECTION—You can look over thousands of card formats, filed by industry and application. One or more of these may provide the key to the card design problem that's troubling you.

DESIGN ASSISTANCE—Our designers are at your service through a nationwide network of Card Design Cen-

CUSTOMER METHODS MEN AND AN IBM SUPPLIES SPECIALIST (left) study a stock card form book and flow charts. By matching the card to the job, you get the most out of your data processing equipment.

THE RIGHT DESIGN. Thousands of stock, special, and continuous card forms, books and sets are on file at IBM Card Sample Centers. One of them might solve your problem.

NEED A SPECIAL CARD? IBM research has developed scented-ink, water-resistant, magnetic-ink-encoded cards—and a host of others, including cards printed in full color.

CREATIVE SKILLS AT YOUR SERVICE. At thirteen IBM Design Centers across the country, experts create cards to meet your specific needs, and bring new efficiency to your data processing operation.

l card design

ters. These experts can help you to develop your own card ideas, to apply existing formats, or to create new, exclusive designs for solving your problems.

EDUCATION—Seminars at our customer education centers, informative literature and plant tours keep you up-to-date on the latest techniques in designing, using and caring for your IBM cards.

FAST CARD DELIVERY—Whether your order is large or small, you get fast service from nationwide manufacturing facilities. IBM gives you prompt service, too, on card designs and card proofs.

Your IBM supplies specialist is the man with the complete punched card story. Let him help you with solutions to your card problems.

IBM.® DATA PROCESSING

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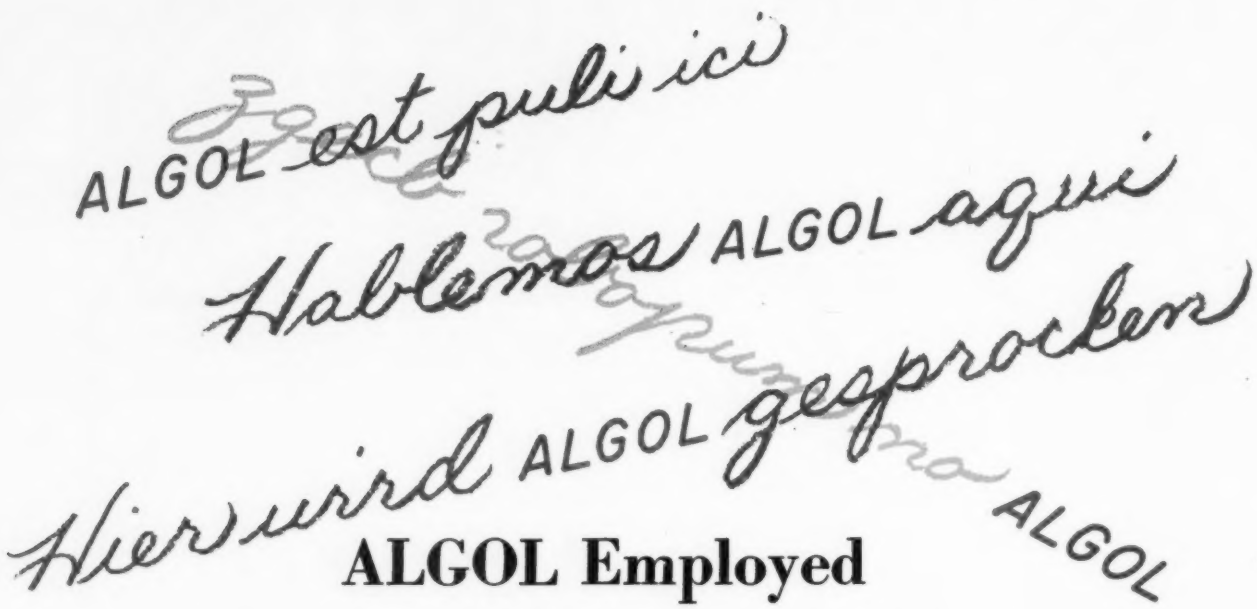


ALGOL Employed

Georgia Tech's use of compiler triples programming speed.

"... AND FOR WANT OF A BATTLE THE KINGDOM WAS LOST."

SUCH is the dolorous end of the old nursery tale that begins with the deficit of one horseshoe nail and traces the consequences down to final disaster.

Electronic computer users, at least until recently, probably appreciated this story's gist more than most folk. The fantastic computational powers and other capacities of their computers were well qualified to handle all their scientific, engineering and data processing problems — or would have been, had not the difficulties of communication with these machines stymied full exploitation of their prowess.

Basic cause of this estrangement was that computers comprehended a language alien to their human users — the so-called machine language which consists of a large number of computer instructions expressed in figures of ten or more digits.

For a programmer to command adequately a computer, it was necessary for him to master this machine language, a task roughly equivalent to his learning Esperanto. Moreover, machine language programming was tedium itself, involving the manipulation of these multi-digit figures through a series of closely-detailed steps.

The "horseshoe nail" that computer users lacked was a method of communicating simply and directly with their machines in a mutually comprehensible language, and for lack of this nail many a computer kingdom was lost indeed. Programming costs, because of the man-hours involved in composing machine language programs, were a major portion of users' budgets, and their dollar weight, added to normal equipment costs, prevented many from becoming users who had problems just begging for computer solution.

Computer manufacturers, increasingly concerned with the communication difficulty, responded by developing "compilers." Basically, these compilers are sets of instructions pre-inserted into a computer that enable it to take problem solutions stated in conventional languages such as algebra and English and convert them into machine language instructions understood by the machine. In effect, compilers are interpreters between man and machine.

ALGOL

Burroughs Corporation was the first manufacturer to implement a compiler for ALGOL, the common international algorithmic language which uses almost pure algebra as its base. Developed for its B 220 computer, the company began distribution of the magnetic tapes on which the compiler is recorded to 220 users in the summer of 1960. (ALGOL was adopted as the common computer language for scientific and engineering usage by a representative international group of mathematicians and logicians meeting in Switzerland in 1958. Currently, representatives of Burroughs and other interested organizations are striving similarly to define COBOL — Common Business

Oriented Language — which would be to business usage as ALGOL is to scientific usage.)

With almost a year's field service under its belt, reports on the ALGOL compiler are now becoming available from users. What have the results been? One user eminently qualified to comment on the subject is the Georgia Institute of Technology where the Burroughs ALGOL compiler has been receiving a vigorous workout since its development. One of the nation's prime producers of top-flight engineers and scientists, Georgia Tech has long pioneered in the field of computer technology. A substantial proof of its interest is the on-campus Rich Electronic Computing Center, an affiliate of the Institute founded in 1955 which has been playing an increasingly prominent role in Georgian academic and scientific life.

The 50-employee center, under the direction of Dr. William F. Atchison, one of the nation's more knowledgeable computer men, acknowledges a dual mission: to serve both the needs of Georgia Tech's students and faculty and of the community at large with its facilities. The academic community at the Institute is afforded every opportunity to grow proficient in the ins and outs of computers. Members of the Center's staff double in brass as lecturers on computer methodology at the Institute, affording its 5,500 students a convenient introduction to the subject. Most of the student — and faculty — use of the computing center's facilities is on an informal basis, however, and done in conjunction with theses and other projects for their technical courses.

Community service

The Center also recognizes its obligations to the community at large which, in its case, is primarily the city in which it is set, Atlanta, the hub of Georgia. This metropolis which, environs and all, now contains a million people, is building and industrializing at a pace unequalled perhaps anywhere in the nation. It takes the capacities of high-speed computers to keep pace with such growth and the data processing, scientific and engineering needs that accompany it, and it is in this area that the Rich Electronic Computing Center of Georgia Tech furthers the total interests of the community.

Currently over three-quarters of the commercial work done at the Center is done on the 220. (Tech students and faculty have virtually unrestricted access to two other computers in the Center as well as the remainder of the work time on the 220.) Besides providing service to the community this non-scholastic outside work is doubly important to the Center since, like most institutions of this kind, it must pay a good part of its own way. And without this commercial work on a cost reimbursement basis, it could not afford to provide the training facilities needed by the fledgling engineers and scientists at the institute.

It is in this commercial area that the ALGOL compiler has most vividly proved its mettle, for its use here constitutes an economic as well as a technological break-through. Best qualified to tell the tale of the compiler is the triumvirate of programmer-analysts at the Center who specialize in 220 operations — Pete Jensen, Bob Techo and Charlie Reed. These musketeers of the computing room have done much work in both machine language programming and with the ALGOL compiler.

ALGOL — a universal tongue. Inscriptions in eight languages on the door to Pete Jensen's office indicate both his affinity for ALGOL and the extreme flexibility of the computer language. Using the ALGOL compiler on the 220 at the Rich Computer Center has resulted in lowering programming costs on commercial computer problems by an average factor of three.

Costs cut

Their estimate is that use of the compiler has cut their fees on outside commercial jobs by a factor of about three. "Depending on the job," said Jensen, "this reduction factor will vary, of course, but three is a fair if somewhat conservative over-all figure."

The savings result from the much shorter time it takes to program a job in ALGOL than in machine language. In the past it has often been heavy programming costs that have discouraged small- and medium-sized firms from utilizing computers on a job-shop basis. The price was just too steep for their budgets.

Says Jensen, "One engineering design problem that formerly carried a charge of $1,500 for us to handle now would scale down to about $500. For $1,500 a small firm might very likely find it couldn't afford to use the computer — and it probably couldn't. So they'd fall back on hand calculations that were safe even if costly in material requirements. But for $500 they can usually fit the computer into their plans and it pays off in

both short- and long-term benefits for the engineering firm and for its client."

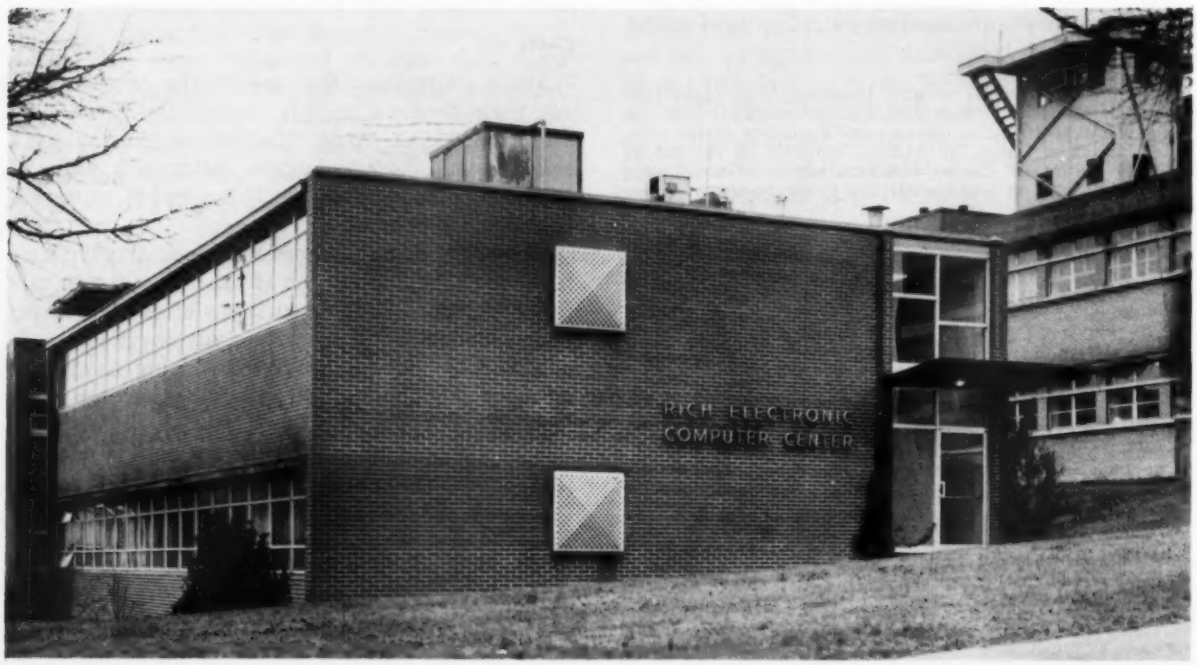
Outside firms, especially engineering firms, frequently come to the Center and ask for the assistance of a computer on a specific design or structural problem. One of the 220 programmers usually will study the problem and work up a preliminary estimate of the cost. Should this be acceptable to the outside firm, the programmer will assimilate the information supplied and prepare the problem for entry into the computer. (These outside concerns usually have no computer men of their own and depend upon the Center's staff to dope out the method of problem solution.)

One engineering firm came recently to the Center with a request for aid in the design of a five-story building. Specifically the firm wanted information concerning the moment distribution in the rigid frame of the building. This is the kind of problem that used to set engineers and draftsmen busily figuring away on their slide rules and desk calculators for long periods of time. A computer can solve the problem in a matter of seconds, but in the past the programming involved had taken up almost as much time as the original hand calculations. By using the ALGOL compiler, Bob Techo, working with a structural engineer, was able to set the problem up for introduction into the 220 computer in a week's time. "Using machine language programming," said Bob, "the same job would have taken me about six weeks." Since programming costs are a very large percentage of the total fee for a job such as this, it's not hard to imagine what this reduction in programming time means in lowering overall charges.

High-speed—reasonable cost

The Center, using ALGOL, is also better prepared to handle problems sent its way from Georgia Tech's wind tunnel, another campus facility available to outside agencies on a cost reimbursement basis. Both the U.S. Air Force and major aircraft manufacturers use the wind tunnel to study the performance characteristics of aircraft and aircraft sections under an assortment of simulated conditions. A large number of instruments, strain gauges and the like, record the raw data from these tests in the form of digital readings. These data are voluminous and pose a sizable data reduction task, but the 220 computer, in combination with the ALGOL compiler, affords high-speed assembly of refined information from these data at a reasonable cost.

Programmer Jensen gives this illuminating if non-technical evaluation of the ALGOL compiler. "Now we can quote bids of from $300 to $500 for some jobs that formerly would have gone for $1,000 to $2,000. And this price differential is often precisely the difference between having or not having the calculating job done on a computer. Center director, Dr. Atchison, sums up the worth of the Burroughs ALGOL compiler thusly: "I don't know of any other tool that has been more effective here at Georgia Tech in dispersing the benefits of computer technology to the students and faculty and to the general engineering public." ■



The Rich Electronic Computer Center is located on the Atlanta campus of the Georgia Institute of Technology.

PWI

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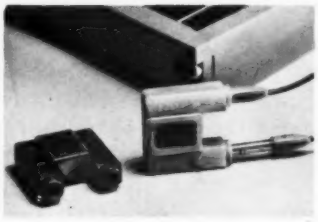
A key punch at your fingertips . . . personalized . . . convenient . . . time saving. PWI offers you the "001", a high precision punch of well proved design—entirely mechanical in operation—priced within a range where purchase on a personalized-use basis can be well justified.

This is a compact punch . . . needs only a small space on your desk top or on computor console. It weighs only a few pounds . . . is easily carried wherever needed. The one-piece solid aluminum base is light in weight yet provides substantial thickness and the solid "feel" every good mechanical key punch must have.

The PWI "001" is being widely used as an extremely handy auxiliary punch . . . for example to replace damaged cards immediately without need to interrupt normal key punch routine. The numerical keyboard is standard design with fourteen keys which include those for space and release. For your convenience, character codes are engraved on the cover plate. Tab stop with quick release and calibrated gear rack make it easy to set card to desired column. Alphabetic or multiple punching is possible without back spacing. Operation is simple—positive—straightforward!

PWI FILTERS for electronic and electro-mechanical computors and tabulators.



Two new PWI filters for elimination of back-circuit "Feedback." Designed for convenient installation. Molded in durable plastic for protection against moisture and physical damage. Two types:
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WJCC

Reported through the eyes and inimitable style of

Jackson W. Granholm*, for Data Processing.

SOME THIRTY-FIVE HUNDRED REGISTRANTS had their intellects extended in Los Angeles. The Western Joint Computer Conference, meeting at the Ambassador Hotel on mid-Wilshire, succeeded in mobbing the place on May 9, 10, and 11. This is no mean feat with the Ambassador. It sprawls over four blocks, pools and lanais included.

This registration sets a brand new very-high for WJCC.

After breakfast on Tuesday, Chairman Walter F. Bauer and Vice-C Keith W. Uncapher escorted the Keynote Speaker into the first press conference. The Keynote Speaker was Thomas J. Watson, Jr., President of International Business Machines Corporation. If there were those who may, in forecasting, have viewed the press conference as throwing Watson to the lions, they were wrong. Mr. Watson gave a particularly smooth and notable account of himself and his company. He answered all queries neatly and directly, pulling no punches.

In his speech which followed, and which was even more smooth than his press conference, Watson noted facetiously that he owed his job to a fortunate choice of parents. His hearers could not believe this. At least he showed astonishing ability before what may be the toughest audience in computerdom.

Among the forthright comments offered by Mr. Watson was the statement that design of the IBM STRETCH had not met the specifications, and, therefore, the price had been reduced correspondingly. IBM, it seems, will lose money on each STRETCH order, and hence will limit the production run of this machine.

Mr. Watson also indicated, however, that he hoped never to see the day when IBM was not working on a machine as advanced, state-of-the-artwise, as STRETCH. He declined to note what the present project might be.

One was left with the distinct impression that, were Mr. Watson to represent his company in every sales contact, there would be little competition left.

From the excellent kickoff provided by Dr. Bauer, Mr. Watson, and Dr. Rubinoff, the technical program continued in the afternoon and through the three days on the same sustained note of competence and excellence. Professor Cornelius Leondes and his committee, the Messrs. Armer and Madden, did the best job to date at a Western Joint.

One would be hard put to select outstanding presentations from among those given. The following mentioned are based chiefly on personal prejudice, on way-outness of topic, or on a certain charm and flamboyance of delivery. In particular, these papers were worth hearing: Dr. Vazsonyi on Management Systems, Kendall Preston on Cellscan, and C. W. Adams on large computers. But if parts of the program were outstanding, it was all excellent—unusually so, in fact.

Of course, a JCC is not limited to program. The social life in the lobby, bars, and antechambers was terrific. As Mrs. Phyllis Huggins, Chairman of ladies activities (whatever they may be) observed, "The WJCC is the best party in town."

This aspect of the Joint got a big impetus on Tuesday evening, sixish, with the cocktail party around the Ambassador pool. The cocktail party, based on the theme, "Extending Man's Intellect through DRINK," resulted, miraculously, in no wet

*Mr. Granholm is an engineer, consultant and free lance writer. Among other things he turns his talents to being publisher and editor of *Computing News* and writing occasionally for other publications lucky enough to catch some of his free (?) time.

casualties. This was in spite of a direct violation of van Praag's law about the proximity of pools to cocktail parties.

On Wednesday, wives went off on a tour of Universal Studios with stop for lunch at Farmer's Market. They were able, thus, to spend the day giving their hangovers the bright sunshine treatment.

Mental Processes, Computer Circuits, and Learning Machines kept the Wednesday morning technical session on a high plane.

By 9:30 AM it was apparent that there was going to be standing room only in the Grove for luncheon, with maybe a few customers hanging from the Cocoanuts. Drawing card for the luncheon was the Speaker, Dr. Simon Ramo, Executive Vice President of Thompson Ramo Wooldridge, Inc. Dr. Ramo's subject was, "Future Applications of Electronic Intelligence." By 11 o'clock luncheon tickets were being scalped in the Ambassador lobby for a purported three to four times par. Takers were not disappointed. Dr. Ramo is a dynamic speaker, and he feels particularly dynamic about the topic he chose.

As always, Thursday tended to be a letdown day, though the technical sessions continued well up to snuff. The usual procession of carpet bags to the airport via the lobby began about noon and was in full swing by official quit time.

Applause for a job well done should surely go to Richard H. Hill, Exhibits Chairman. The Arcade Floor of the Ambassador is exceedingly well-suited for use as an exhibit hall, and the exhibits were well laid out. In previous years, there has been a good deal of griping and grumbling among exhibitors, some of whom resented being placed upstairs in the corner broom closet. This year the only grumbling was from exhibitors who failed to reserve early, and, as a consequence, ended up with zero exhibit space.

As usual, the Western Joint was the occasion for sundry committee meetings, rump sessions, and cocktail bar critiques, organized and unorganized — scheduled and unscheduled. It was preceded on Monday by the RAND invitational session which annually discusses what's up in the computer world. Another session saw Willis Ware elected to the brand new Chairmanship of AFIPS. In addition to the chance meetings of old friends in hall, lobby, and ballroom, there were such specialized doings as the F. Gruenberger symposium for former residents of Richland, Washington.

AFIPS, the American Federation of Information Processing Societies, is made up of the same participants as the old NJCC. However, its charter is a little broader, and it is empowered to do more than deliberate and put on conferences. Chances are, more participating societies will be asked to join, or will ask. Sad to relate, the chief loud proponent of AFIPS formation (and he may even have invented the name) for the past several years was not noticed to be present. This person is, of course, the hirsute and reverend Dr. Herbert R. J. Grosch.

Public Relations Chairman Santo Lanzarotta, aided and abetted by Norm Lynn, did a commendable job of scheduling events for the press, technical and otherwise. For example, there was always hot coffee in the press room, and doughnuts for those who didn't worry about avoirdupois. A special press session on the Friday preceding went over coming highlights of the conference for those who cared to get a clean typewriter and a stack of paper set to go.

Marvin Howard, in charge of registration, had his work cut out for him. The ample booth in the south end of the Ambassador lobby looked like bargain day in Macy's basement at 9:00 AM on Tuesday, and the rush was repeated all over again when it became apparent on Wednesday that luncheon tickets were sold out. Marvin kept it all under control, shuffling briskly here and there in the cloud of smog from his ever-present cigar. So magnificent was his demeanor in the face of pressure that unknowing out-of-towners were heard to ask, "Is that Groucho Marx?"

Mrs. Huggins kept the ladies busy with coffee on the patio, a quasi-technical session, and lunch on Tuesday, and the aforementioned Wednesday tour. Only problem was, coffee hour found no chairs on the Lido Patio, and lunch somehow got overlooked by the Ambassador.

This latter pair of glitches points up the one sour note of the conference: All the goofs were provided by the Hotel. The Ambassador has been the Soiree Seraglio of Los Angeles for a good

many years. It seems to be slipping a bit these days, though. Conference arrangements seem, if the hearsay is not heresy, to have required about one too many iterations, and yet to have come off a trifle lopsided in some instances. The demeanor of the Ambassador bears out such an approach, for the carpets are a little too faded, and the trappings a little jaded, and, all in all, the Cocoanuts in the Grove look as though their milk had long since dried up. In fact, one gets the distinct impression that not much has been done to update the Ambassador since John Barrymore used to drop in every other night.

For the kind of show the Western Joint has grown to be, this is not good enough. A conference of this size is worthy of the best that any hostel has to offer.

Nonetheless, Dr. Walter Bauer and his friends have done the best job to date on an E or WJCC. Whoever is next will have a high mark at which to aim.

After being on the inside of the conference with Mr. Granholm, some might still like to know what topics were discussed. For these, we list:

Simulation: A Survey, H. H. Harman, Systems Development Corporation.

Management Games and Computers, J. M. Kibbee, Remington Rand Univac.

An On-line Management System Using English Language, A. Vazsonyi, Ramo-Wooldridge.

Application of Digital Simulation Techniques to Highway Design Problems, A. Glickstein and S. L. Levy, Midwest Research Institute.

Use of Manned Simulation in the Design of an Operational Control System, M. A. Geisler and W. A. Steger, The RAND Corporation.

Survey of Microsystem Electronics, Peter B. Myers, Semiconductor Products Division of Motorola, Inc.

Testing of Micrologic Elements, Richard Anderson, Fairchild Semiconductor Corporation.

Interconnection Techniques for Semiconductor Networks, J. S. Kilby, Texas Instruments, Inc.

Microsystem Computer Techniques, E. Luedicke and A. H. Medwin, Radio Corporation of America.

Introduction: Modeling Human Mental Processes, H. A. Simon, RAND Corporation.

Simulation of Verbal Learning Behavior, E. Feigenbaum, University of California and RAND Corporation consultant.

Simulation of Behavior in the Binary Choice Experiment, J. Feldman, University of California.

Programming a Model of Human Concept Formulation, C. I. Havland and E. B. Hunt, Yale University.

Parallelism in Computer Organization Random Number Generation in the Fixed-Plus-Variable Computer System, M. Aoki and G. Estrin, University of California, and T. Lang, National Cash Register Company.

CELLSCAN System — A Leucocyte Pattern Analyzer, Kendall Preston, Perkin-Elmer Corporation.

Application of Computers to Circuit Design for Univac Larc, G. Kaskey and H. Lukoff, Remington Rand Univac, and N. S. Prywes, University of Pennsylvania, also consultant to Remington Rand Univac.

Wide Temperature Range Coincident Current Core Memories, R. S. Weisz and M. Rosenberg, Ampex Computer Products Company.

Tunnel Diode Balanced Pair Circuit as Building Blocks for High-Speed Computers, H. S. Miller, W. E. Barnette, G. A. Brown, S. Fiarman and R. A. Powlus, Radio Corporation of America.

Descriptive Languages and Problem Solving, Marvin Minsky, Massachusetts Institute of Technology.

Baseball: An Automatic Question-Answerer, Bert F. Green, Jr., Alice K. Wolf, Carol Chomsky, and Kenneth Laughery, Lincoln Laboratory, Massachusetts Institute of Technology.

A Basis for a Mathematical Theory of Computation, John McCarthy, Massachusetts Institute of Technology.

Information Retrieval: State of the Art, Don R. Swanson, Ramo-Wooldridge.

Technical Information Flow Pattern, M. M. Kessler, Lincoln Laboratory, Massachusetts Institute of Technology.

A Screening Method for Large Information Retrieval Systems, Robert T. Moore, National Bureau of Standards.

What Is an Intelligent Machine? W. Ross Ashby, University of Illinois.

Analysis of Perceptrons, H. D. Block, Cornell University.

Some Physiology of Automata, M. L. Babcock, University of Illinois.

Combined Analog-Digital Computing Elements, Hermann Schmid, Link Division, General Precision, Inc.

Optimization of Analog Computer Linear System Dynamic Characteristics, C. H. Single and E. M. Billinghurst, Beckman/Berkeley Division.

Design and Development of a Sampled-Data Simulator, J. E. Reich and J. J. Perez, Space Technology Laboratories, Inc.

Digital Clock Delay Generators and Run Counter for a Repetitive Analog Computer, T. Brubaker and H. Eckes, University of Arizona.

Trends in Design of Large Computer Systems, C. W. Adams, Charles W. Adams Associates.

Current Problems in Automatic Programming, A. Opler, Computer Usage Company.

A First Version of UNCOL, T. B. Steel, Jr., System Development Corporation.

Method of Combining ALGOL and COBOL, J. E. Sammet, Sylvania Electric Products.

ALGY — An Algebraic Manipulation Program, M. D. Bernick, E. D. Callender and J. R. Sanford, Philco Corporation.

A New Approach to the Functional Design of a Digital Computer, R. S. Barton, Computer Consultant.

The JOVIAL Checker, M. Wilkerson, System Development Corporation.

Factors Affecting the Choice of Memory, Claude F. King, Logicon, Inc.

A Nondestructive Readout Film Memory, Richard J. Petschauer and Rodney D. Turnquist, Remington Rand Univac.

Tunnel Diode Storage Using Current Sensing, E. R. Beck, D. A. Savitt and A. E. Whiteside, The Bendix Corporation.

Development of a New Nondestructive Memory Element, A. W. Vinal, IBM Corporation, Federal Systems Division.

High-Speed Optical Computers and Quantum Transition Memory Devices, Lewis C. Clapp, Computer Development Laboratory, Sylvania Electronic Systems.

Optimization of a Radar and Its Environment by Geese General Electric Electronics Systems Evaluator Techniques, L. Berger and R. M. Taylor, General Electric Defense Systems Department.

Spectral Evaluation of Iterative Differential Analyzer Integration Techniques, Max Gilliland, Berkeley Division, Beckman Instruments.

An Iteration Procedure for Parametric Model Building and Boundary Value Problems, Walter Brunner, Electronic Associates, Princeton Computation Center.

Analog Simulation of Underground Water Flow in the Los Angeles Coastal Plain, D. A. Darms, EAI Computation Center, and H. N. Tyson, IBM Corporation, formerly with EAI Computation Center.

A Self-Organizing Recognition System, J. R. Singer, University of California.

A Pattern Recognition Program that Generates, Evaluates, and Adjusts Its Own Operators, L. Uhr, University of Michigan, and C. Vossler, System Development Corporation.

An Experimental Program for the Selection of Disjunctive "Hypotheses," M. Kochen, IBM Corporation.

Time-Analysis of Logical Processes in Man, U. Neisser, Brandeis University.

Computer-Based Management Control, A. J. Rowe, Hughes Aircraft Company.

American Airlines "SABRE" Electronic Reservations System, M. N. Perry and W. R. Plugge, American Airlines.

Real-Time Management Control at Hughes Aircraft, D. R. Pardee, Hughes Aircraft Company.

The 465L (SACCS) Computer Application, P. D. Hildebrandt, System Development Corporation.

Computer Simulation of a Colonial, Socio-Economic Society, Warren Dee Howard, Defense Systems Division of General Motors Corporation.

X-15 Analog Flight Simulation Program Systems Development and Pilot Training, N. R. Cooper, North American Aviation, Inc.

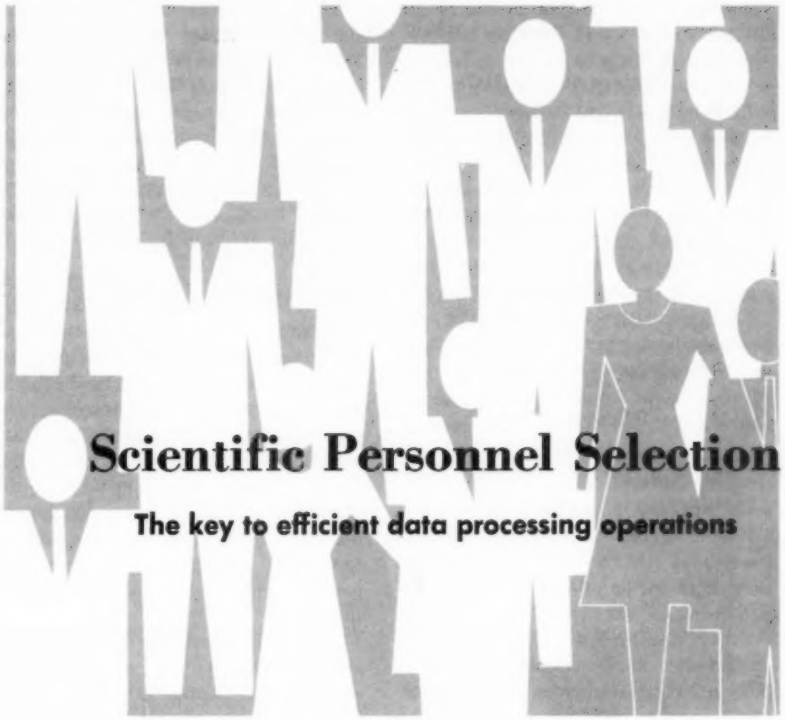
Analog-Digital Hybrid Computers in Simulation with Humans and Hardware, Owen F. Thomas, Simulation and Computer Center, U. S. Naval Ordnance Test Station.

Automatic Determination of Human and Other System Parameters, T. F. Potts, G. N. Ornstein and A. B. Clymer, North American Aviation, Inc.

■ ■ ■

Scientific Personnel Selection

The key to efficient data processing operations



By Raymond Dreyfack

THE FOOTBALL TEAM with the best coach, the best plays and the best signals will turn in the worst performance without the proper team members and team spirit to coordinate the action. The same thing holds true in the data processing department.

Numerous speeches have been made, articles and books written, on the need for scientific selection and handling of personnel, but enough will never be said on the subject. All the concepts, suspects and precepts of management are meaningless without the judicious application of the most vital ingredient of all: people. This creed should be indelibly etched in the minds of all managers.

Many companies set up elaborate procedures in order to hire the "right man" for the job of running the data processing operation, then leave the ball firmly planted in his hands and forget about it. Up to this point all may be well. But if a quarterback is to run with the ball he's going to need some good interference ahead of him; if he decides to pass he'll need a good receiver.

Selection of data processing personnel should be the combined responsibility of the department manager and the personnel office, with top management keeping one eye alert to the situation.

One of the biggest pitfalls to sidestep is the problem of urgency that constantly seems to confront many data processing managers. In this field rush jobs have a unique way of developing out of nowhere. Paperwork volumes mushroom out of proportion when least expected. Expansion sometimes takes on a surprising air of spontaneity. To put it more bluntly: too often friend manager finds himself in somewhat of a bind. He needs a keypuncher, an operator, a clerk in a hurry. He doesn't have as much time as he'd like to screen and interview.

Is it that pressing?

There's a fire to be put out and inadequate time to recruit firemen. This can be a dangerous situation, particularly if there's a union involved. A man gets hired, presumably on a trial basis. Once on the payroll, however, it may be all too easy for him to become rooted, even if he's not up to snuff. Once thrown into contact with other individuals with responsibilities, objectives and philosophies less company-geared than those of the manager, a different picture comes on the screen.

"It's true," one of the new man's co-workers will reason, "Joe is slow in grasping assignments. He's a little lazy too if you don't watch him closely, but all in all he's not a bad guy, and how he does his job isn't my headache. *I'm not getting paid to be a policeman.* Besides, the guy has a wife and three kids. I don't want to be the one to get him canned."

So, when friend manager comes around and asks how Joe is doing, the answer is a noncommital, "Okay."

This is further aggravated by the fact that the new hire usually puts his best foot forward when he starts the job. If that foot is kind of sore to begin with, what will it be later on? You can't blame the employee on the job either for his attitude. After all, he didn't do the hiring, why should he share in the responsibility? The manager is paid to do this. It's *his* job.

This is an accurate statement of fact. It's the manager's obligation to see that the best man gets hired, and to follow up to determine that performance and ability are living up to expectations.

Another easy way for the busy manager to step into the manhole and pull the cover over his head is to make his selection from a too limited number of applicants. An operator is needed, for example, again in a hurry. An ad is placed in the local paper, maybe two or three employment agencies called. But the weather is pretty bad out, or it's a rough time of the year. Only two people show up for the job. Neither of them seems a ball of fire, but old Pappy Time is pressing again, and if we allow this interview routine to continue too long we'll fall further and further behind in the work.

So, against his better judgment, perhaps, the manager will select one of the two duds. At this point he's had it.

No matter how busy the department, or how pressing the need, no company can afford to hire substandard help. If the alternative is to wait, or even to up the ante a little to get the right kind of help, it's preferable to do so. The cost of in-

competence reflected in terms of production of quality and quantity is far more than many managers would like to believe.

The tolerating of unsatisfactory standards of performance is a disease which will spread to every facet of the business. The insidious thing about it is that not all the infected areas are readily apparent. Morale may be seriously affected, job turnover stimulated, loyalty impaired. In extreme cases even the company image — the way the organization appears to outsiders — may be negatively changed.

Clarify qualifications

One of the first steps when considering a new hire for the data processing department is to set straight in the mind of the department head involved precisely what is needed in terms of experience, background and ability. When this is clearly defined the information should be made available to the personnel department. This implies an accurate statement of job description. A vague, nebulous idea is not enough. Neither is the general knowledge that another man is needed because it's getting busy.

Exactly what will be the duties and responsibilities of the new employee when he starts? What will he be doing six months, a year, possibly even five years hence? The applicant is entitled to have this information for his own personal evaluation. The data processing and personnel managers should know for their own planning and evaluation.

Seniority could also be a key consideration. Let's say we have three operators on the job. We're about to hire a fourth in a rapidly expanding installation. At present, and perhaps for six months to come, the ability to wire plugboards will not be a requirement of the job. However, as the installation grows, this ability will assume added importance.

This doesn't mean we have to hire an expert wirer. But we should hire a man with the realization that he'll have to be trained in this work. More important, he must be an individual who is *capable* of absorbing the training when the time comes. Not everyone can fill this bill. Most operators would like to wire. Many are too lazy to apply themselves to the training. Others are not mentally suited to grasp the knowledge. It is singularly unfair to force upon any individual mental effort that is beyond his natural capacity. This practice makes for a tense and unhappy employee. It also encourages disharmony and inefficiency in the department.

Job needs, both immediate and projected, must be carefully appraised when the decision to hire is made.

Transfer or new hire?

Here's another consideration: A man is needed for the data processing department. Should he be hired from within the company or recruited from the outside? There are many pros and cons on both sides of the coin. Generally speaking, hiring from within is strongly recommended. However, this too can be carried to impractical extremes, especially where technical know-how is involved.

If a data processing department is suffering from lack of technically experienced people, another novice added to the staff can compound an already existing thin-ice situation. More than one installation has fallen flat on its processing proboscis on this score.

On the other hand, there is often a double experience factor to consider. Most insurance companies, for example, feel that the business know-how of its data processing employees is far more critical — and often more complicated — than the technical know-how from a data processing standpoint. These firms, therefore, set up veteran statistical, accounting or actuarial employees as data processing administrators, with technically trained supervisors working under them. The same general policy would be followed down the line to include subordinate employees.

Also of prime importance is the ever-present morale consideration. Employees want to be made to feel that they have some place to go. Large companies especially are becoming increasingly aware of this need.

Dr. Yale J. Laitin, President, Survey Research Associates, Scarsdale, New York, points this out as one of the most critical findings in his attitude evaluation studies conducted for many of the country's leading corporations.

Says Dr. Laitin: "'Not enough chance for advancement', is a frequently cited reason for employee dissatisfaction. Many people, sometimes without being consciously aware of the fact, sense that they're in a rut, and react accordingly. This reflects in their enthusiasm, is made evident in their performance, and, in extreme cases, seriously affects their feeling of loyalty towards the company."

In many firms the data processing department is an excellent proving ground for employees on the way up. Progressive data processing and personnel managers take this into active consideration, and lay the ground work accordingly.

Quite often, for example, "crash" situations may be anticipated. In company X new outlets are being opened, new programs developed. There is every reason to expect that within six months a 20% burden will be added to the data processing department. Translated into staff requirements this may be boiled down to two additional keypunchers, an operator and a clerk.

Training plans may be made accordingly. Four potentially qualified girls from the clerical pool can be sent to key punching school, the two with the best scores selected. If outside technical experience is indicated, a search can be made a few weeks prior to the date of urgency, a break-in cushion provided for, the best operator narrowed out from a choice of six or seven candidates.

Time is the best ally a manager can have on his side when selecting personnel. Scientific screening and interview techniques are also extremely helpful.

Personnel testing

There are a large number of personnel tests available designed to determine the ability and suitability of employees on all levels of responsibility. Of prime importance are the skill and experience of examining personnel. There's an art to giving tests. There's an even greater art to their scoring and evaluation. This is where personnel department know-how stands to good advantage as an aid to the data processing manager. The screening function, properly applied, is definitely a conjunctive enterprise.

In addition, most manufacturers

of computers and punched card equipment have their own tests available at no cost. IBM, for example, offers tests that are highly effective in determining the potential success or failure of the programming candidate. This is particularly helpful in view of today's rapidly expanding electronic developments. Programming skills are somewhat unique. While math is sometimes an important factor the mere fact that an individual is good at algebra does not mean he will necessarily become a good programmer. In many cases persons with limited educational background, but possessed of a special kind of orderliness and systemization of thought processes, have developed into top notch programmers. IBM tests and those of other manufacturers are designed to isolate unique characteristics of this kind.

One advantage enjoyed, but not always utilized by data processing managers, is that technical know-how can't be easily faked. You either have it or you don't. If the prospect is asked: "Is an X punch the only impulse that can be used to pick up an X-selector?" he can't hem and haw his way out of it. If he doesn't know that a "12" punch will accomplish the same objective he can respond by saying he doesn't know, or even less effectively by a dumb, blank expression more eloquent than words.

Still, some data processing managers prefer to be the "good guy" and take the applicant's word for experience given. I wonder how many interviews have gone something like this:

Applicant: "Sure, I did a lot of wiring on my last job."

Manager: "What boards did you work on?"

Applicant: "Collator, tab, 604. All of them."

Manager: "Fine. You're hired."

This is a good blueprint of how *not* to hire a data processing technician.

The experienced head of a data processing installation knows that all it takes is eight or ten pointed questions to verify an applicant's wiring ability. If he's too embarrassed to ask these questions he may find himself considerably more embarrassed later on when he has to fire the applicant for being a bluff — or, worse, if he gets stuck with a dud he can't easily remove because of union and seniority regulations.

Last, but far from least in the vital consideration department is follow-up. We're all of us human, and even the best laid plans "aft gang astray." Hiring a new employee, then forgetting about him, is poor management practice. It's not fair to the individual because the worst treatment you can give any person is to ignore him. It's not fair to yourself as manager because for your own benefit and enlightenment you should keep tabs on all your help. It's not fair to your company, because an employer is entitled to a fair shake for its salary with the fringe on top — and it's your job to see that it gets it. ■

SEEN IN PRINT

AUTOMATIC DRAFTING MOVES CLOSER. Control Engineering. February, 1961.

A modified Charactron tube output printer turns out a working print in less time than is required to make the magnetic tapes that control the programmed machine tool — using the same input, and no draftsman. The print may be used prior to the first manufacturing operation as a check on the correctness of the machine tool tape; inspectors receive copies of the print before the first parts are produced. The cost is high, but may be justified by using the printer for other applications in the computer installation.

MAINTAINING A COMPLEX ELECTRONIC INSTALLATION, by Thomas R. Darmody. Journal of Machine Accounting. March, 1961.

The more complex a computer installation, the more rigorous must be its maintenance procedures. A computer's time can be worth hundreds of dollars an hour. Lost time is so costly that effective maintenance procedures are an economic necessity. Corrective and preventive maintenance schedules must be set up and followed in accordance with standard procedures. The installation must be willing to put effort into designing maintenance procedures and check-out routines, and must allow maintenance time in the machine schedule.

Another need is for a clear line of communications from the installation to the customer engineers, so that time lost because of unscheduled break-downs is not compounded by delay in getting to the maintenance staff.

MANAGEMENT'S FIGHT AGAINST "TECHNOPHOBIA," by A. M. Sullivan. Dun's Review and Modern Industry. April, 1961.

Change is inevitable, and in an organization resistance to change is, too. "Technophobia" — fear of technology — is not new, but is getting increasing attention as the pace of technological change quickens. If management is afraid of technological change, the company will not survive. Of equal importance, management must neither ignore nor bow to the fears (often irrational) of its employees. The best way to combat these fears is to be candid. Whenever changes are scheduled for either office or factory, they should be preceded by enough information to forestall rumors and convince employees that the change is inevitable.

■ ■ ■

Punched Card Ideas

BILL KLUMPP

MULTI-LINE LEDGER POSTING

Spirit duplicating fluids and the bottleneck of line by line transfer posting have been eliminated by the Addressograph Multigraph Transfer Printer Model 831. A heat transfer process has been perfected. Eight lines are posted by one impression, if the accounting machine list is run with a carriage setting of six lines to the inch. Eleven lines are posted if the list is run with a setting of eight lines to the inch.

The transfer master

The transfer master of courses and grades is run on the accounting machine from punched grade cards onto an inexpensive continuous paper master backed by a sheet of continuous "transfer" carbon. Mirror-image characters are produced on the reverse side of the master. From collated punched grade cards, the student's name and a maximum of eleven courses and grades are listed on the master. Opaque or translucent permanent records suitable for any reproductive process can be made.

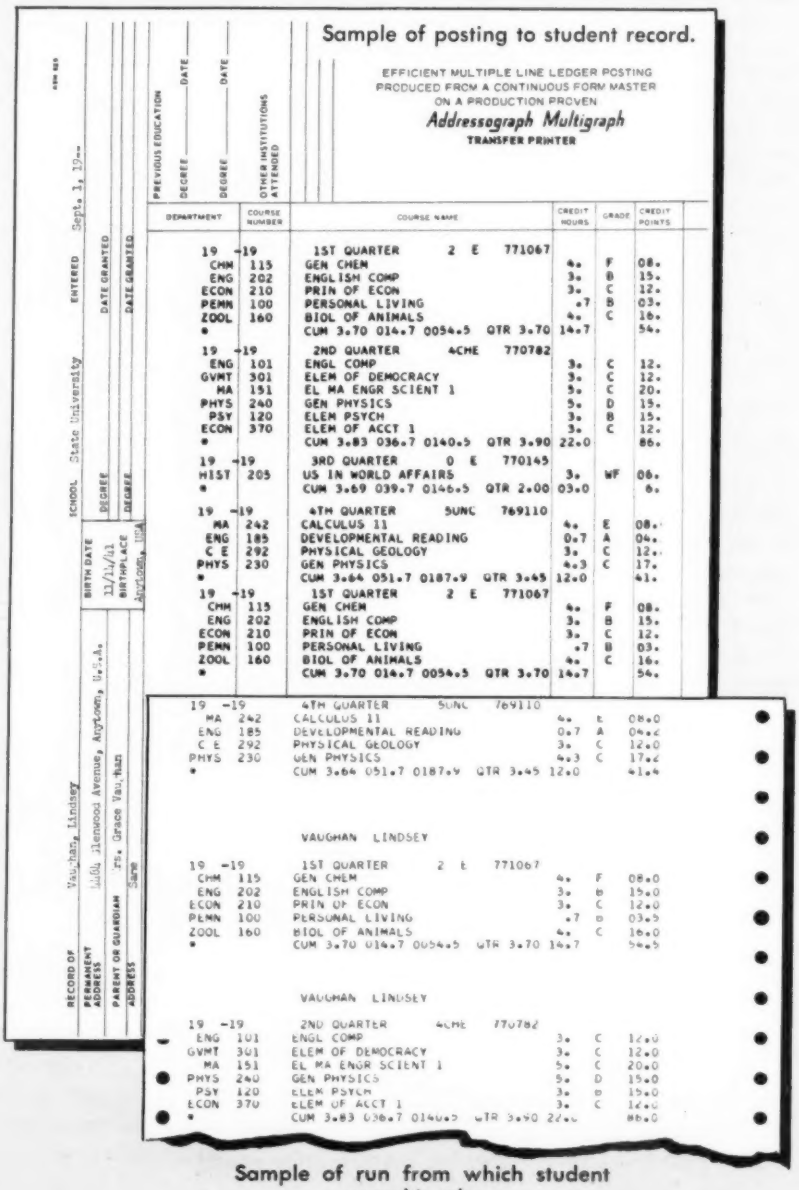
The posting procedure

The operator manually positions the ledger under the platen and master. The ledger is indexed from its last line of previous posting with a specially designed line-finding gauge; the platen (foot pedal activated) applies controlled heat and pressure to transfer the image directly to the unit form.

The transfer-printed impressions are black and permanent. The maximum line length is twelve inches; the maximum printing area is twelve square inches. Once the operator settles into a rhythm of motion, as many as 700 multiple-line records per hour can be posted.

Additional machine arrangements

Friction, suction or shuttle attachments can be added to convert the transfer printer into a form feeding machine. It can then accommodate the full range of unit business forms or mailing pieces. Photo cell control devices can be arranged to scan marks placed on the continuous input master, causing the machine to stop, skip or separate groups of forms on the conveyor discharge. The Transfer Printer thus supplements punched card equipment, automates the office more completely and increases the distribution potential of a high school, college or university. ■



Sample of run from which student record is taken.

RAY MARIEN

—A Monthly Feature **Marien on FORMS**

Consolidating Forms Orders

ONE OF THE MOST DIFFICULT JOBS in forms procurement is the consolidation of orders for the express purpose of saving money. This certainly sounds easy enough, if you believe that volume buying leads to lower prices. And it does, when you buy a larger quantity of a *given* item. But forms are not one *single* item. They may be classed as one commodity, but they encompass a wide range of designs, constructions, and prices.

Obviously, you can't combine dissimilar forms on one order just to save money. It just can't be done. The single, flat, cut form — 8½" x 11" — bears only one relationship to the four-part continuous form — they are both printed on *paper*. And chances are that the paper is different so there is no chance of economy *there*.

To combine forms for lower unit cost you must narrow your consolidations down to: 1) forms of the same kind, but being bought at different locations or intervals (*purchase orders, invoices, bills of lading*) or, 2) forms of similar construction and in like quantities (*20,000 each of four-part, 8½" x 7" snapout sets, with the same weight, grade and color sequence of paper and carbons*).

Rounding up all the same forms is not much of a problem. You run a survey and pull in all your purchase orders, for example. You ask for estimated annual usages and quantities on hand at each location. You should also check out the price paid for each lot. Then you place one combination purchase order for, let's say, a one year's supply for all locations. If they were all ordered separately before, chances are that your unit price will be cut by as much as 50%. Let's see why this is so.

Every time a small order is placed for the form, either new composition is set up (*if it's a new vendor*) or the old plate is taken out and the press made ready for the run. If the run is small, this composition and set-up time may amount to half the total cost! Multiply that by the number of different orders placed and you get some idea of the excess charges you pay by decentralizing your buying of such forms! Add in the clerical time used in obtaining bids and writing separate purchase orders and you see another reason for combining the run.

Now, once the order is consolidated there is only *one* of everything: composition, make-ready, press run and — purchase order. You get the *price* of the total long run, plus an additional charge for stopping the press for each address change. This is relatively small — usually a flat extra. The printer's costs go *down* as the length of the run increases. Those savings are passed along to you.

Try combining form runs

How about combining forms that have different designs but are constructed the same? Simple, but you do need one other common factor — *quantity*. You do not necessarily have to have the same number of *each* form. The same *multiple* may work out fine. For example, if I need 50,000 of form A, 25,000 of form B and 125,000 of form C, they can be combined effectively to achieve a lower unit cost simply by resorting to a gang run. An eight-up plate might be used, with *two* form A plates, one for form B, and *five* for form C. After a single press run of 25,000 impressions, the printer has produced the exact quantity required of each form!

Ganging forms in this manner may lead to some "forcing" of quantities to fit them into the required multiples, but this is not a drawback unless it is overdone. When forcing results in over-ordering or *under*-ordering, you may lose more than you gain from "ganging."

Another way of saving money in forms buying is to take advantage of the *printer's* gang runs. That means let him run *your* job along with those from other companies in the same manner described above. In that way, your single run of 25,000 forms would gain all the cost advantages of a multiple run.

Some forms are easy to work into a consolidated order because of essentially simple construction. Tags and labels fit into that category. The simpler the form, the easier the combined order. Flat, cut forms offer an opportunity for a forms printing contract. If you standardize on one weight and grade of paper and line up 100 or more 8½" x 11", or 11" x 17" forms (*or multiples thereof*) the printer will give you an excellent unit price on them. Not only because he can gang them in dozens of different ways, but because he can put them on the press with other jobs. Such an agreement is only practical, however, if it is understood that he sets his own printing schedule. By that I mean he must work on a "minimum stock" basis with an automatic reprint right (*provided you haven't red-flagged any of the forms*). In that way he can keep his equipment busy, establish a profitable schedule and still meet your delivery dates. He may never run the full amount on *any* form at one time, but his price will be just as low because his idle press time is cut to a minimum.

Such an arrangement is usually coupled with a stocking agreement so that the printer acts as your forms storeroom. He is solely responsible for keeping those shelves filled and he works under a blanket contract with the right of automatic reprint when he *wants* to run the job. Naturally, if he runs more than the stipulated contract amounts, he gambles that you'll use them up. If a form should be obsoleted after he's made a large over-run, *he* takes the loss. ■

IBM® 1418 Optical reads printed

Direct input to a computer *without manual keypunching*—that's how the 1418 dramatically boosts input speeds, and raises over-all efficiency.

Typical example: in a job that normally would call for 20,000 punched cards, the 1418 reduces 200 hours of keypunching and verifying to *one hour* of "reading." The 1418 reads numerical data and marks on bills, invoices, checks and other papers at speeds up to 480 characters a second... and up to 400 documents a minute.

Character Reader numbers directly into the 1401 system

Reading is *optical*—no special inks required. Documents prepared on 407 accounting machines, 1403 printers, typewriters equipped with IBM 407 type, or credit imprinters with elongated 407 type, are the "reading matter" for the 1418. Since your 1401 computer controls the feeding of documents into the 1418 reader, you can get either continuous or interrupted feeding for special processing.

Depending on your needs, there are two 1418 models to select from. One has three stacking hoppers. For more complex sorting jobs, there's another with thirteen which sorts documents either under 1401 control, or independently.

Optional features include: a second optical reading station which permits two lines to be read on a single pass; a mark reading station for reading pen or pencil marks optically.

For more facts about how the 1418 increases the through-put of your 1401 System, call your IBM Representative.

IBM®
DATA PROCESSING

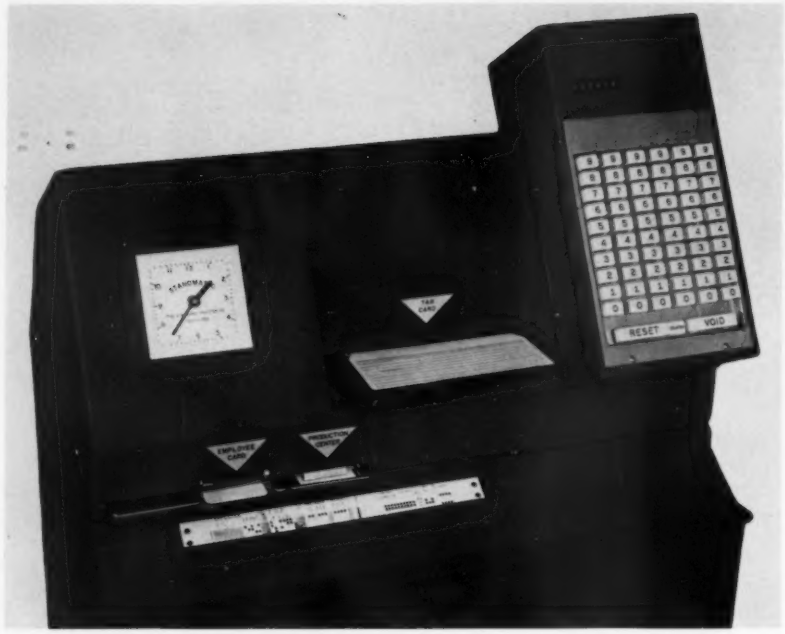
Circle no. 11 on reader service card.

NEW EQUIPMENT

NEW DATA COLLECTION DEVICE

The Standard Register Company has introduced a source data collector called the Stanrecorder. Input, at the transaction source, is by embossed plastic plates, integral time clocks, prepunched cards, and manual keyboard. Data are recorded in both machine readable and man readable styles on two-part, continuous, marginally punched forms. One or both copies may be retained in a locked compartment of the Stanrecorder, which can hold 3,000 forms in recording position and another 3,000 in storage.

The forms may be fed into the Stanomatic Reader-Translator, for automatic conversion to magnetic tape, punched cards, or punched paper tape; or they may be given to keypunch operators for manual transcription (in low volume jobs), since the data contained are readable by human beings as well as machines.



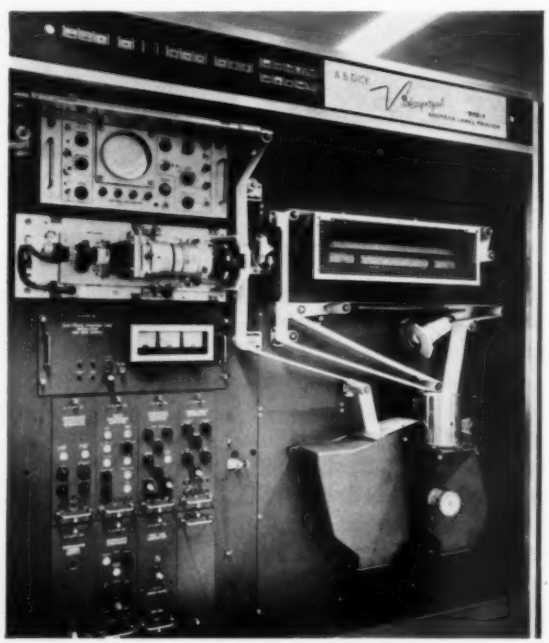
The Stanrecorder is small (requiring about three square feet of space), portable, and operates from a standard 115-volt AC outlet. An optional production-counting device is available which, for instance, can cause the Stanrecorder to register the number of pieces produced by a factory machine.

Circle no. 30 on reader service card.

VIDEOGRAPH 910 PRINTER

The A. B. Dick Videograph 910 Address-Label Printer can produce over 130,000 five-line addresses per hour, on labels designed for conventional affixing or, through a simple control which produces a mirror image address, on heat transfer labels. Designed for organizations with large-volume mailing operations, a typical system includes magnetic tape units, a buffer and control unit, and the 910 printer. The printer and buffer unit can also be used on-line, with input from the central processor of a computer. The usual large-volume method is to maintain the mailing lists on magnetic tapes, which are read by the tape handlers in an off-line addressing operation.

Information from the tapes is passed to a unit called the Tape Reader and Buffer Unit. This unit has logic and control circuits for pre-printer editing, and (in its function as a buffer) has enough storage space so that as many as 84 "dead" records can be rejected without delaying the printer. Magnetic tape



records can be condensed by use of a 144 character buffer store capable of repetitive read-out of the city and state line.

The 910 printer accepts a six bit parallel binary code carrying both address data and programming signals, and prints on label rolls 1" x 2¾". An automatic device splices in a standby roll when the primary roll is exhausted; a new roll is placed in the printer about once each thirty minutes. Character generation is at over 20,000 characters per second, of 64 different letters, numbers, and symbols. Printing is a dry, heat-fixing process using an electrostatic printing tube, toner powders and an infrared fusing device. An alarm system stops the machine and lights indicators to show trouble sources.

Circle no. 31 on reader service card.

FIRST STRETCH DELIVERED

After five years of development, the first IBM STRETCH computer has been delivered to the Los Alamos Scientific Laboratory, near Santa Fe, New Mexico. Six trucks were needed to haul STRETCH over a week-long, two thousand mile journey from IBM's production shops at Poughkeepsie, New York. If STRETCH had been operating during that week, it could have performed the 250 billion computations required for mathematical simulation of a complete hydrogen weapon test.

In addition to weapons test simulation, the Los Alamos STRETCH will be used in research studies aimed at designing a nuclear power plant for space ships; finding a method of producing controlled thermonuclear fusions; and exploring radiation effects.

The memory used in the Los Alamos version of STRETCH is prodigious. Over 1.5 million decimal digits of capacity are available in six interrelated magnetic core storage units. The addressing system of this core storage has been set up so that the core capacity can be more than doubled in the future. Access time is 2.1 microseconds.

A new magnetic disc file is also part of the Los Alamos STRETCH. The discs can store over two million words, a word consisting of sixty-four information bits. The entire contents of the disc unit can be moved into the main core memory in less than half a minute. The relatively fast transfer time is due to the use of forty arms with seventy-eight disc faces: horizontal seek movement is required, but there is no need for time-consuming vertical movement, as is found in single, double, and triple-arm disc units.

STRETCH, using fourteen digit numbers, can do an addition in 1.5 microseconds; a multiplication in 2.7 microseconds; or a division in around 10 microseconds. This works out to over thirty billion multiplications in a 24 hour period.

Of even greater interest than STRETCH's very fast internal speed are various design features which give great flexibility to both the programmer and the machine. Through multi-programming (time-sharing), as many as nine programs have been run simultaneously in test periods. The operator's console is disassociated from the system in such a way as to make possible not only input-output functions, but also an unusually high degree of control. The console includes a sixteen-position digital display.

Other organizational features of the Los Alamos STRETCH are the Exchange, a special-purpose computer which monitors and switches a flow of up to 800,000 characters per second through the system's input and output units; the Instruction Processor, which is a small computer which sets preliminary circuits for up to ten instructions; a Look-Ahead device, which accepts preprocessed instructions and their data from the Instruction Processor and holds them until needed; two dissimilar arithmetic units, one a ninety-six bit parallel floating point unit, the other a variable-length unit capable of decimal, binary, and logical modes; and an extensive priority interrupt system.

Circle no. 32 on reader service card.

IBM 7072

The IBM 7072 is an intermediate data processing system designed for scientific and commercial applications which do not require the high input-output speeds of the 7074.

Similar to the 7074, the new system offers priority processing; simultaneous read, write and compute; field definition and indexing features, and a comprehensive, fully compatible program library, including IBM's FORTRAN, AUTOCODER, SORT and MERGE, REPORT GENERATOR and IOCS (Input Output Control System) programs. Also featured are full parallel arithmetic and an improved high-speed floating decimal arithmetic.

Either 5,000 or 10,000 ten-digit decimal words of magnetic core storage are available for the 7072. A special optional feature of the system permits expansion of the core storage in modules of 5,000 to a total of 30,000 words of memory. The system, approximately two-and-one-half times faster internally than the IBM 704, has access to data stored

(continued on next page)

in memory in six-millionths of a second.

Binary recorded information from magnetic tape may be read directly into the 7072 which converts it, through a program subroutine, into decimal data.

The 7072 operates as a tape-oriented system, utilizing the IBM 1401 data processing system for data input and output preparation at high speeds. It is equipped with the new 7330 low-cost, intermediate-speed magnetic tape units which operate at 7,200 or 20,000 characters a second.

The 7501 console card reader provides direct punched card input to the 7072 system. It serves as a communications link between the operator and the tape-oriented 7072, to handle small-volume card input — such as program patching cards. The 7501 reads numerically punched cards serially at a rate of sixty cards a minute under control of the stored program. Alphameric data can be read in two-digit notation.

Monthly rental of a typical IBM 7072 data processing system, including the 1401 and six 7330 magnetic tape units, is $19,825. Purchase price of this system would be $860,550.

Circle no. 33 on reader service card.

IBM 7072

PROCESSING SPEEDS

	Microseconds	Operations per Second
Fixed Point		
Addition/subtraction (six digits)	12	83,300
Multiplication (ten digits x ten digits)	64 average	15,600 average
Division (20 by 10)	94 average	10,500 average
Logical Decisions	6 to 14	up to 166,700
Floating Point		
Addition	20	50,000
Subtraction	26	38,400
Multiplication (8 x 8)	64 average	15,600 average
Division (8 digit average quotient)	95	10,500
Access Time		
Core Storage	6	
Data Transmission Rates		
Core to core, per 100-word block	12 average, per word	
Tape Speeds		
7330 magnetic tape units	7,200 or 20,000 characters per second	

PHILCO 2400 PERIPHERAL COMPUTER SYSTEM

The Philco 2400 electronic data processing system is a new concept in peripheral computer design which relieves the Philco 2000 central computer of many routine tasks and adds 25 percent to the time available for the central computer to process computational problems.

The new system is now available for order with delivery ranging from 12 to 18 months, depending upon customer specifications.

The 2400 system will include the 2400 central processor with 8,192 characters of high-speed core storage, one magnetic tape unit with a transfer rate of 90,000 characters per second, a card reader which reads 2,250 cards per minute, a high speed printer which prints 900 lines per minute and a card punch. The 2400 will be used in conjunction with the 2000 computer.

The 2400 processor includes stored-program functions such as editing, search and select, sorting and data translations. The basic system provides for additional input-output devices and memory expansion. Reduction of floor space, maintenance, power, and operator controls are features of the 2400's compact design.

The 2400 does all input-output functions for 2000 systems, and uses

standard Philco input-output devices and magnetic tape units. It combines stored-program input-output processing with a minimum of control circuitry for each device, minimizes operator functions, and eliminates programmed plugboards.

A 2000 and a 2400 system can be coordinated to operate in parallel on portions of a job best suited to each computer, reducing problem time and increasing system capacity.

The Philco 2400 asynchronous design permits a maximum amount of simultaneous input-output operations.

System organization

The 2400 complements the high-speed precision of the Philco 2000's 48-bit, fixed binary organization by adding the flexibility of character-oriented data handling. Character-serial operations handle variable lengths of input-output data; manipulate data character-by-character and bit-by-bit for editing and code translating; make input-output channels interchangeable and readily adaptable to other peripheral devices; accommodate code formats of other computer systems; and reduce hardware requirements.

The Philco 2400 has asynchronous organization of memory, processor, program control, independent input-output channels, and high speed core storage of up to 32,768 directly addressable characters.

Asynchronous time-sharing of components, plus dual program control, allow at least four devices (two complete input-output operations) to proceed concurrently and make use of the memory transfer rate of three microseconds per character. A card-to-tape operation and a tape-to-printer operation, both with edit, for example, are performed at maximum device speed.

Up to eight magnetic tape units can be addressed by each input-output channel selected for magnetic tape use. An input-output channel may be directly connected to a Philco 2000 tape control and share any of eight on-line tape units. Two magnetic tape channels can be operated simultaneously for a read-write speed of up to 180,000 characters per second.

The control console's monitoring and control are designed to service input-output devices. These features include an automatic load control, and a monitor typewriter which provides access to memory locations and program control.

The selection of input-output operations is controlled by a combination of operator inputs, program, and controls which are coded into the data itself. This selection includes control of information to be punched and/or printed, determining an end of information, the accumulation of control totals, and the mode of printing.

Circle no. 34 on reader service card. ■

DeParis

(continued from page 20)

amount field producing an adding machine tape of the individual items and a total at the end of batches.

Obviously, this provides real-time verifying, and with the right application, avoids tying up an expensive tabulator for a simple balancing job. There are single and duplex register models available which will accommodate one or two 12-position totals.

An interesting sidelight is that the combination of punch and Monroe verifier can be used effectively as a small batch tabulator. Punched cards can be read into the punch automatically, listed and totaled on the Monroe, without operator intervention.

Still another device is the Synchro-Monroe Card Tabulator. This is a table model utility tabulator which lists, adds, and subtracts numerical data from punched cards. The unit consists of a card reader and a Monroe adding machine. There is no control panel, fields being defined by setting of control knobs. A field of as many as eleven columns can be accumulated in one pass. The hopper will hold up to 600 cards; cards are read at the rate of 60 per minute, even though they may be bent or crumpled.

Other developments in the area of punched card equipment are taking place regularly. IBM and Rem-Rand have low-priced limited speed systems which bring the equipment within the reach of even small users. The integrated data processing applications which involve punched cards seem limitless. Special, manual, lever-operated punching devices for use in areas remote from the central data processing location are produced by several manufacturers. IBM now offers the 407 in Model E-4, a reduced capacity lower-priced model.

This column has not attempted to summarize all or even most of the advances of recent years in punched card equipment. Rather we have attempted to highlight some unusual equipment being developed and offered by other than the more prominent suppliers in the punched card field. We have tried to bring into focus the fact that, although overshadowed by electronic data processing, punched card data processing is receiving the attention it warrants from the inventive genius of American business. ■

NATIONAL CASH REGISTER has a series of new *package programs* which provide low cost electronic data processing services for companies without computers in New York, Dayton, and suburban Los Angeles. Paper tapes can be mailed from anywhere to these centers for processing.

STONE LABORATORIES, INC. recently announced its *TELLERTRON system* for savings institutions which represents a breakthrough in the development of economically feasible real-time updating and transaction processing systems. This system is primarily a large, high-speed information retrieval system which can handle one institution with many branches or a group of cooperating institutions.

HONEYWELL — Representatives of 26 Honeywell 800 users and prospective users met recently in Detroit to found the *Honeywell 800 User's Association*. John J. Koerner of the Associated Hospital Service of N. Y. was elected president; Raymond E. Harbaugh, Philadelphia Gas & Electric Co., vice-president; and Bert L. Neff, Metropolitan Life Insurance Co., secretary-treasurer. The Association will meet twice annually; the next meeting will be October 26-27 at Houston, Texas.

PEOPLE PLACES

Karl R. Jensen

BURROUGHS Corporation appointed *Karl R. Jensen* the new publicity manager of their Equipment and Systems Marketing division. Burroughs also announced the retirement of *William C. Sproull*, for 35 years advertising director for the corporation.

C-E-I-R has a new director of computer services at Arlington in *Charles F. Crichton*, and for the Information Processing Technology division a new director of information processing in *David M. Smith*.

ELECTRONICS ENGINEERING Company of California named *William M. Hawkins, Jr.* as assistant sales manager — a new post.

ELLIOTT INDUSTRIES, INC. appointed *Joseph H. Laurinec* manager-custom machines.

AMERICAN BUSINESS SYSTEMS, INC. has *Lloyd W. Sorenson* as their new director of marketing.

AUERBACH ELECTRONICS Corporation's changes include *Arthur D. Hughes* as senior member of the technical staff; *Allen H. Kaltman*, senior member of the product and market planning staff; and *Mrs. Joyce Finley*, a member of the technical staff.

AUTONETICS' Computers and Data Systems division named *Raymond M. Bukaty* assistant to the vice president.

BENDIX moves include: *Dr. R. D. O'Neal*, vp-engineering, and *R. H. Isaacs*, vp-government relations, to the administration committee; *Vernon P. Magnuson's* appointment to manager of advanced development-engineering; *Fred W. Bauer* as new market analysis manager for the computer division; *Anthony Costantino* as manager of customer engineering-computers; *William Driedger* as new district manager for Detroit and *Tom Klest*, new district manager for Denver.

Bendix (Pacific) announced the appointment of *Dr. John A. F. Gerrard* as director of electronics engineering.

BRYANT COMPUTER PRODUCTS promoted *G. Harry Ashbridge* to manager of product planning and *Alvin Kovalsky* to electrical design supervisor.

IBM promotions include: *Warren C. Hume*, general manager of the data processing division; *William B. Ewald, Jr.*, public affairs services manager; *Frank H. McCracken*, midwestern regional manager; and *Ralph C. Sampson*, director of customer engineering.

LITTON INDUSTRIES changes: *Norman H. Enenstein* was promoted to director of technical administration; *George T. Scharffenberger* moved to vice presidency, as well as serving as president of the subsidiary, Westrex; *Dr. J. Richard Hechtel* joined the research staff.

Victor V. R. Symonds has been appointed contracts manager and *J. M. Bridgman*, vice president and general manager of Litton Systems (Canada) Ltd.

AT PHILCO, *A. F. Parker* will head the computer division's export sales and *George W. Rees* will be manager of the new customer services. The new Aero-Space Computer section will have *William E. Bradley* as manager and *George H. Heilborne* in charge of marketing.

AT RCA's EDP division, *Everett M. Kruger* is the new manager of systems-procedures and *Arthur A. Katz* fills the new position of manager, applied programming.

REMINGTON RAND UNIVAC's changes include: *Edwin S. McCollister*, director of marketing; *Joel M. Kibbee*, director of education; *Myron A. Angier*, general sales manager; *John N. Veale*, western regional marketing manager at Los Angeles; and *Victor H. Hiers*, director of engineering for Remington Rand Systems.

John D. Hazzard is marketing manager for the new mid-eastern region and *James P. Conville* is the new plant manager in Tonawanda, N. Y.

SOCIETY FOR THE ADVANCEMENT OF MANAGEMENT elected *James E. Newsome* chairman of the board, with *Robert B. Curry* as S.A.M.'s prexy. Executive vice president is *Fred E. Harrell;* other vice presidents are: *J. Gordon Campbell, Hezz Stringfield, Jr., Edward D. Kemble, James B. DuPrau*, and *Henry J. Arends*.

SOUNDSCRIBER Corporation appointed *Ellis J. McClanahan* as executive consultant.

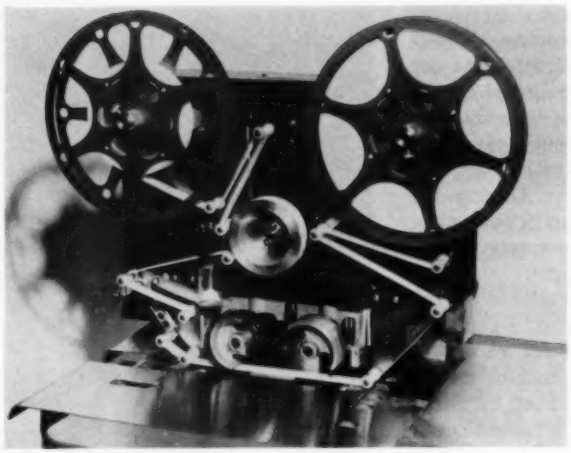
ENNIS BUSINESS FORMS' *W. R. Schween* was elected president of the Tabulating Card Manufacturers Association. Vice president is *W. Y. Startzman* and secretary-treasurer, *C. A. Greathouse*.

TELEREGISTER Corporation has named *Dr. Leon Davidson* new manager of their programming section-engineering.

FRED G. WOLFF has entered the consulting field at Paoli. He will specialize in specification, system, and logical design and evaluation of computer peripheral devices.

EDWARD THORP, a mathematics instructor at Massachusetts Institute of Technology, developed a *strategy for winning at blackjack, or twenty-one*. With the aid of an electronic computer, he extended calculations previously performed on a desk calculator by four Army men at Aberdeen Proving Ground. The odds on any one hand change considerably, depending on what cards have been eliminated, during the pass through the deck. Whether the player or the house will have longer odds depends on the elimination of specific cards. The system, sadly enough, is workable only if the player has a great deal of capital and time with which to accumulate substantial winnings. ■

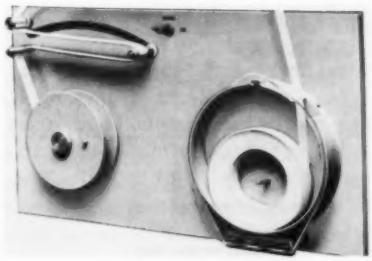
PRODUCTS SERVICES



TAPE LISTER

Scriptomatic has a new tape lister attachment for their Model 10 addressing machine which prints from typewritten card masters (punched card or plain) a five line name and address directly to tape at approximately 8,000 an hour. A selector feature with notched master cards permits the machine to print or skip, with tape held for the next impression during skip. Provision is made for chemical moistening control whether there is print or skip. The unit is attached by two thumb screws for easy positioning.

Circle no. 40 on reader service card.



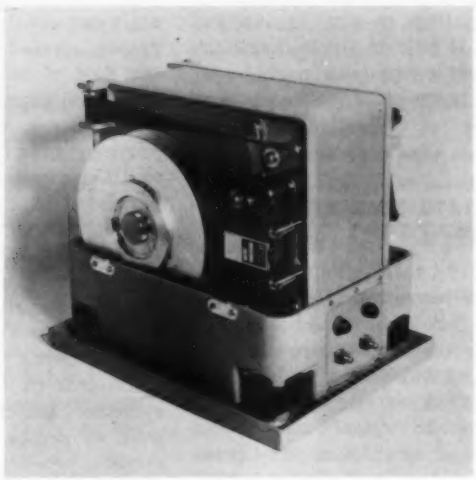
TAPE HANDLER

Digitronics' new uni-directional perforated tape handler, Dykor 4544, handles five to eight channel tape interchangeably, and operates at speeds up to 500 characters a second, 50 inches a second motion.

It is designed to work with the Dykor 3500 photo-electric tape reader. To load, the tape is put in the input bin and threaded through the reader on a servo controlled take-up spool.

The unit measures 10½ inches in height, 19 inches in width, and 8¼ inches in depth.

Circle no. 41 on reader service card.



M-H DIGITAL RECORDING SYSTEM

Minneapolis-Honeywell's new portable digital recording system is designed for unattended data acquisition over long periods. The 6150 Incremental Digital Recording system is completely transistorized. It acquires asynchronous data by a tape stepping method. At a nominal stepping speed of 30 steps a second (200 steps per inch of tape), 38 hours of continuous recording can be handled on one reel of tape. At lower sampling speeds, the tape supply from one reel is adequate to allow automatic operation for a year or longer.

Power requirement for the recorder is eight watts, allowing it to be operated with two standard 12-volt automobile batteries, or 60 to 400 cps, 1/95-125 V AC.

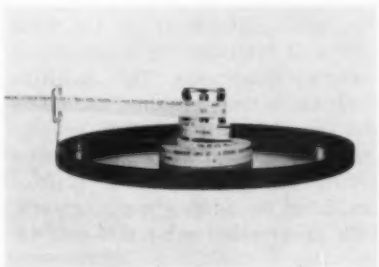
Data is recorded on track widths and spacings compatible with most standard computers or data transcribing units. The reels are interchangeable with any laboratory type tape-handling equipment. The system can be arranged at the factory to operate with one-half, three-quarter, or one inch tape. It may be used for monitoring servo lines by incorporating a servo repeater and encoder in a second housing.

Circle no. 42 on reader service card.

CYCLE TAPE-MINDER

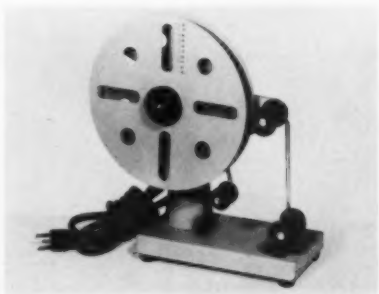
Matched equipment for Cycle Universal Tape-Minder is a machine that automatically winds up to one inch perforated message tape or data processing tape as it is produced. The twelve-inch 302 Unwinder has a tape guide which permits tape to travel up or down, to right or left, so that no special positioning is required of the Unwinder for delivery to equipment receiving the tape.

Circle no. 43 on reader service card.



TAPE THREADING WINDERS

The Whiteford Laboratory of Lynn, Massachusetts, has a series of *right side* tape winders which may be used as an integral component of communication, electronic or data processing equipment. The winders come with six, eight, or 12-inch diameter reels, and will hold



90 feet of tape per inch of diameter. The Whiteford Winder has no clutches, belts, interference signal, oscillating or arm or interval switches. It adjusts automatically to output speeds and tensions for continuous, intermittent, or unattended operation.

Circle no. 44 on reader service card.

IBM 1410 SIMULATES 650

IBM has a 650 simulation program for the 1410 which simplifies the programming transition from one computer to the other, enabling reprogramming of some 650 routines to be deferred until after a 1410 has been installed.

The simulator extends the life and usefulness of established 650 libraries, and seldom-used or "one-shot" 650 routines need not be reprogrammed. The simulator will be available on a field-test basis in September, 1961.

Circle no. 45 on reader service card.

IBM 1203 UNIT INSCRIBER

Another unit in MICR service to the banking industry is the IBM 1203 unit inscriber for magnetically encoding documents. This machine combines listing, proving, endorsing and inscribing functions in one operation. The 1203 has a ten-key adding machine keyboard. Entries are listed on adding machine tape, with progressive sub-totals and totals for proving against control lists. As a by-product of proving, the machine magnetically inscribes the ten digit amount field, bracketed by the proper symbol, and a process control field of one to four digits. Two additional digits in the process control field are available. During the proving and inscribing operation, partial or full endorsements can be imprinted on the checks.

Special features available on the 1203 are: A warning light and keyboard lock to indicate an out-of-balance condition; document counting, to total the number of documents passing through the machine; inscription of transit numbers and symbols; inscription, in a second pass, of account number and on-us symbol; repetitive printing of a specific digit in the unit position of the process control field for checks. When the subtract key is depressed, an alternate digit — identifying credit — prints automatically.

Monthly rental of the basic 1203 inscriber is $135; purchase price is $5,900.

Circle no. 46 on reader service card.

VISI-SHELF FILES

Visi-Shelf File, Inc. has a new series of shelf filing units, the D series, designed for maximum record protection where dirt, dust, water and fire are factors. These units have the drop door exclusive with Visi-Shelf.

The O series units offer maximum filing space with greatest floor space saving. The E series offer economy in either letter or legal size with a three inch folder frontal overhand.

All units have face-mounted reference shelves tilting, fingertip compressors, facile guide pulls, individual locks and range finders. All units are available in 30 inch or 36 inch widths, with a choice of seven to ten openings, providing 96 different styles and filing combinations.

Circle no. 47 on reader service card.

DUPLICARD

Microfilm Products, Minnesota Mining and Manufacturing Company subsidiary, has developed a new card for producing greater clarity in third and fourth generations of duplicate microfilm aperture cards.

This new card is used for making duplicates of original Filmsort cards. It uses a new type of diazo film which produces clearer images on reader screens as well as sharper prints in most processes than possible with previously available diazo film.

The new Duplicard is designed for use in 3M's new copier, Filmsort

Uniprinter 041, which produces the Duplicards at a rate of 2,000 an hour with only periodic attention and little manual control.

Circle no. 48 on reader service card.

FARRINGTON MACHINES

A new line of printing and embossing machines was recently introduced by Farrington Business Machines Corp., subsidiary of Farrington Manufacturing Co.

The 450 printer is a fully automatic machine for preparing a wide variety of office and factory paperwork from embossed metal plates. It is designed to handle payrolls, statements, invoices, dividends, production control forms, plant maintenance instructions, and the like. The printer will accommodate extra large forms and has a large capacity plate magazine with plugboard selection.

The 620 automatic embosser will produce either metal or plastic plates. It has a capacity of 90 characters which are displayed on an illuminated dial in a sequence planned for speedy location.

Circle no. 49 on reader service card.

LEASE PLAN FROM R-R

Remington Rand is offering all their systems equipment on a lease plan, available on a monthly rate. At the end of the primary lease term the lease may be renewed on an annual basis with costs just slightly more than the monthly payment, or the equipment may be turned in for newer models. Included in the lease plan: office furniture, vertical filing equipment, microfilm equipment, insulated products, and Library Bureau equipment.

Circle no. 50 on reader service card.

ADDRESSOGRAPH PLATES TO COMPUTER LANGUAGE

A Service Department of Rabinow Engineering Co., Washington, D.C., will handle conversion of Addressograph plate impressions to electronic data processing language. This will be done through a Rabinow Universal Reader for automatically reading plate impressions and simultaneously converting them to computer language.

The RUR is capable of handling all existing metal address plate fonts. It will read them electronically at a rate of six or more lines of print a second and convert them in proper code on computer input media such as punched paper tape, magnetic tape or punched cards. A list of one million names and addresses can be converted in less than 150 machine hours as opposed to several months of other types of conversion.

This service will be available in about six months. It is expected that eventually the operation will be expanded to include address lists now on spirit duplicating or other masters.

Circle no. 51 on reader service card.

TAPE FOR PHOTO-ELECTRIC READERS

Paper Manufacturers Co., Philadelphia, has new developments in punched tapes for photo-electric applications. By using various combinations of mylar/paper, mylar/foil, and metallized mylar, a tape can be designed to meet many requirements.

They handle all types of data processing tapes in standard and special widths, oiled or unoiled, plain or printed, and in a variety of colors. Many of these items are available in either rolls of different diameters or folded in 8½ inch or 19 inch folds.

Circle no. 52 on reader service card. ■

DATA PROCESSING BINDERS

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NOTABLE QUOTES

"The reaction time of management must shorten. The time for leeway in adapting to new technologies has disappeared. Companies must keep track of a number of fundamental areas of scientific work and must react rapidly to apply this work when the time is right. They must consciously plan to be the ones who obsolete not only their own products, but their very industries.

"The life of business and industrial *processes*, as well as *products*, are being both shortened and changed. Much of the new technology, particularly that part of it dealing with information processing, profoundly changes the manner in which business is conducted.

"For example, the American Telephone and Telegraph Company expects communication between machines in different cities to exceed voice communication over telephone lines by 1970. The consequences of such a change are staggering, not only for the telephone system, but for the procedures by which the remainder of U. S. business is conducted! It is only through a high order of planning that such a rate of change can be made to benefit a firm rather than its competitor." John Diebold. "Technology's Challenge to Management." *Journal of Machine Accounting*. February, 1961.

□

"The image which many employers, unions, citizens, and educators have of the man at work is already somewhat behind the times, and will change even more radically during the sixties. Perhaps the more significant changes in this image are these:

a. The drastic rise in the number of professional, technical, managerial and staff specialists in industry, and the prospect of even greater increase in the years ahead;

b. A leveling off or decline in the number of unskilled workers, and a further drastic falling off of the ranks of farmers and farm workers;

c. The demand for more skilled workers, with the further provision that many new skilled trades will be demanded, together with changes in the present lines of craft organization of the work force; and

d. An increase in the number of service, clerical and sales workers which exceeds all other categories of occupations." George S. Odiorne. "Jobs and Working Conditions in the Sixties." *Michigan Business Review*. March, 1961.

□

"To help control the quality of lower echelon decisions, the high-compensation industries tend to hold individuals accountable for their actions to a greater degree than do the low-compensation industries.

"Both groups of industries require teamwork, of course, but the 'togetherness' factor in the decision-making process of the lower compensation industries acts to protect the inadequate executive from his own insufficiency. He 'participates' in the decision — by consultation, or as a member of a committee — but the risk is borne by the team rather than by the individual. Since he rarely has final authority (unless he is the chief executive), the individual cannot be held accountable.

"The committee, like a wartime convoy which moves at the speed of the slowest ship, tends to be paced by its least effective member. By the same token, a relatively poor executive can survive in this environment without doing serious damage to the company, for his inadequacy is supported by the consultative decision-making process.

"The executive in the higher compensation industries, by contrast, tends to be more exposed to his own weaknesses. Since he has the authority to make certain profit-influencing decisions, the effects of his individual actions are quickly translated into red or black ink on the P & L statement. Since a weak executive can cost the company a lot of money, the decisions of the individual are under constant review. This assumes, of course, that adequate controls have been set up as part of the decentralization of the decision-making process.

"Executives working in such an individual-centered environment are worth more than their opposites in a team-centered company, since their individual skill directly affects the profits. And, since they are accountable for their actions, their job security depends heavily on their individual effectiveness." Arch Patton. "What Is an Executive Worth?" *Harvard Business Review*. March/April, 1961.

□

"Optimum can be construed to mean practically any degree of operation efficiency — given in any organization the management calibre, amount of flexibility in management planning, and the amount of competition.

"For any one management to accept an 'optimum' solution, that solution must conform to the prejudices and experience of that management, as well as to its capabilities. There are also the factors of management's judgment and hopes. Usually an 'optimum' solution is not 'optimum' unless it takes these into consideration, insofar as that management is concerned. Should the right weights be given these management considerations in arriving at the 'optimum' solution, this management will be willing to use the mathematical solution, but in terms of the management 'art.'

"As an organization progresses in time, the problem of 'optimization of business operations' is indeed a 'never-ending' one. This can be overcome only by flexibility in planning, and the realization that constant problem review and re-solution are necessary." Raymond Overell. Readers' and Editors' Forum. *Computers and Automation*. March, 1961.

DATA . . . yours for the asking

FMA, INC., which operates over a range of electro-optical fields, has a two color booklet available outlining their research, development and production capabilities. The company's special areas are information storage and handling, electronics systems, optics and photography, quantum electronics, and mechanical and electro-mechanical systems.

Circle no. 70 on reader service card.

A TEN PAGE FOLDER is also ready on FMA FileSearch, an automated system for information storage and retrieval. The folder relates the complete operation of the process from the initial document analysis and indexing to the hard copy output. It describes a typical business or industry file problem and how FileSearch solves it.

Circle no. 71 on reader service card.

MONARCH METAL PRODUCTS, INC. has just issued a 20 page brochure introducing their new magnetic tape storage and handling equipment.

Circle no. 72 on reader service card.

MS&A, INC., computer consultants and engineers, has published an eight page brochure describing its services in systems engineering, logic design, and computer programming.

Circle no. 73 on reader service card.

"CHECK THAT MICRO-FILM PROJECTOR, I DON'T THINK THEY'RE CHECKING THE AJAX COMPANY ESTIMATES!"

U. S. ARMY ROCKET AND GUIDED MISSILE Agency (ARGMA) has an eight page illustrated booklet describing their Filmsort operations wherein 850,000 active items are instantly retrieved from files of two million drawings.

Circle no. 74 on reader service card.

LITTON INDUSTRIES has available several pieces of literature on its products:

1. The 1961 Electron Tube Condensed Catalog gives quick reference specifications on the complete line of microwave tubes, display devices and operational accessories, as well as millimeter wave tubes and monitor diodes.

Circle no. 75 on reader service card.

2. A complete description of the Type RA-1656 punched tape reader, which can read punched tape at the rate of 1500 characters a second, and can stop on character at 500 characters a second.

Circle no. 76 on reader service card.

3. A bulletin describing the Westrex 1580 magnetic recording/reproducing head is available with full specifications and a performance curve.

Circle no. 77 on reader service card.

ALLEN HOLLANDER COMPANY, INC., has issued an eight page folder describing low cost stock labels, custom labels, and Able Labels.

Circle no. 78 on reader service card.

"INDEXING — VITAL TO DATA PROCESSING," a new 16 page booklet by G. J. Aigner Company, describes new indexing products which have been developed for data processing. They include continuous strips of index inserts which can be printed with titles on automatic printing equipment, punched card guides which will run through data processing equipment, control-punched indexes for continuous forms, and special guides for filing punched cards.

Circle no. 79 on reader service card.

UNITED DATA CONTROL, INC. has a new bulletin on commercial air line recorders which discusses recorder applications for continuous monitoring of commercial aircraft for accident analysis, airworthiness and maintenance; also covered are reliability requirements and data reduction methods.

Circle no. 80 on reader service card.

"BUSINESS FORMS AS A MANAGEMENT TOOL," by Watts Business Forms division of Alfred Allen Watts Co., tells why paperwork has become increasingly noted by management. Fourteen case studies are cited illustrating the results possible through improved design, function and control of business forms. Another feature points out possible troublesome areas in the use of business forms.

Circle no. 81 on reader service card.

VISI-SHELF FILING SYSTEM is discussed in a new catalog issued by Visi-Shelf File, Inc. which includes the new series. D, O and E. All filing units are available in either 30" or 36" width, and a choice of four heights and from seven to ten openings provides 96 different styles and filing combinations.

Circle no. 82 on reader service card.

THE SERVICE BUREAU CORPORATION has literature available entitled "Accounting for Fire & Casualty Insurance Agencies."

Circle no. 83 on reader service card.

"FORMS CONTROL MANUAL," published by LOMA, is a guide to the development and preparation of forms for those individuals responsible for the development of company forms and the procedures about which they revolve. It outlines the program and establishes standards that will insure uniformity and simplification in recording, transmitting, reporting, and other processing of data throughout a life insurance company.

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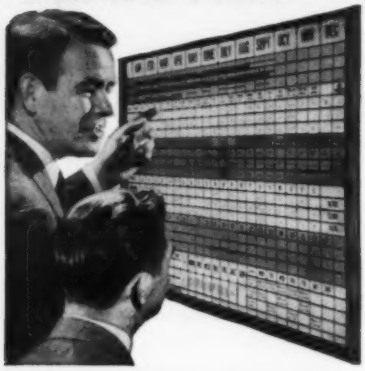

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BOOK SHELF

TRANSMISSION OF INFORMATION by Robert M. Fano. Published jointly by MIT Press and John Wiley & Sons, Inc., 440 Park Ave., New York 16, N. Y. 365 pages. $7.50.

Although this book is written primarily for communications engineers and graduate students in electrical engineering, it will be of interest to those who are in communications. It presents the foundations and results of the information transmission theory. The development of communications theory—transmission from source through encoders to channels and decoders to users — is explained as proceeding from two theories which are the works of Norbert Wiener and Claude Shannon. The text is devoted to the second branch of communications theory which originates from Shannon's work. Chapters are devoted to a measure of information, message ensembles, discrete stochastic sources, transmission channels, with several chapters on encoding and decoding. The appendix contains a series of problem tables of entropy and Gaussian distribution functions. The author assumes his audience has a mathematical background which includes knowledge of probability theory and of Fourier analysis.

PROCEEDINGS OF THE 1960, NINTH ANNUAL MEETING. Standards Engineers Society, Inc., 1025 Connecticut Ave., Washington 6, D. C. 88 pages. $5.00.

From the opening address throughout the several articles stress is placed on the influence of standardization as a factor to advance the American free enterprise system in world competition. Several less significant problems are identified by the following examples:

"So long as a West German company can produce a keg of nails, ship it to Detroit, and sell it there at a profit at less than it costs a Detroit company to manufacture . . . there is a real question as to the path of the U. S. economy."

"Some people like to focus on relative wage rates as the culprit behind the decline of U. S. industrial profits."

Standardization can combat the economic trends. Several ideas are well presented and developed: *Psychological Influences in Standardization* by Modhu S. Gokbale; *Better Engineering Writing* by Richard M. Koff — a useful, brief suggestion for any writing; *Number Systems* by Joseph Mozia and James V. Panke; and *Electronic Computers* — a New and Powerful Tool in Standardization by Andrew J. Pepper.

GUIDE TO U. S. GOVERNMENT STATISTICS by John L. Andriot. Third Edition. Documents Index, Box 453, Arlington 10, Va. 1961. 400 pages. $15.00.

This book is a reference to permit quick location of statistical sources by subject and to provide a comprehensive guide to statistical contents of the huge output of Federal publications.

This guide is updated every other year, in odd years, and a supplemental volume will be available in even years beginning with 1962. Together, these two volumes will be the most comprehensive reference tool on statistical information issued by the Federal Government.

PROGRAMMING FOR DIGITAL COMPUTERS by J. F. Davison. M. A. Business Publications Limited, Mercury House, 109 Waterloo Road, London, S. E. 1, England. 1961. 175 pages. 35 shillings.

A primer for newcomers to the rapidly developing field of computer work, the book covers an introduction to computers, the role of the pro-

grammer, his job, details of programming, more sophisticated techniques and automatic coding. It winds up with a discussion of the variations in computers and peripheral equipment, without specifically naming machines.

EXECUTIVE CONTROL AND DATA PROCESSING by Lowell H. Hattery. Anderson Kramer Associates, 1722 H Street, N. W., Washington 6, D. C. 1959. 92 pages.

A practical, compact review of data processing with computer systems in terms of providing better executive control of a business, Mr. Hattery's work is helpful in specifically defining the benefits and limitations of computer systems. Several check lists are presented covering executive responsibilities, report criteria, and which are helpful for determination of the data processing system to be used.

An unusual number of specific and useful guides are condensed into the 92 pages of this book.

SEQUENTIAL DECODING by John M. Wozencraft and Barney Reiffen. Published jointly by The Technology Press of M.I.T. and John Wiley & Sons, Inc., 440 Park Ave., New York 16, N. Y. 1961. 74 pages. $3.75.

A monograph of a new series which covers coding theory related to data communications. Readers should have an elementary knowledge of calculus and probability theory. This research study, intended for communications engineers, covers an investigation of the problem in designing systems whose performance approaches the bounds of coding theory in communications. Study was done at M.I.T. Lincoln Laboratory with an IBM 704 computer system used in part. This monograph points out that coding and decoding can become a practical design technique available to the communications systems engineer, data processing engineer, and information theorists. ■

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editorial

Let's Face the Facts about Personnel Displacement

ANY COMPANY which does not seriously consider the effect that new data processing techniques have on personnel is flirting with chaos. And it is sure to invite the intervention of the labor union and the federal government.

What are the facts concerning the effect of data processing systems on personnel displacement? What do the experts say? Well, today you "just pays your money and picks your expert." Unfortunately the extremist views are the ones which have been most widely publicized thus far. This is much too serious a matter to exaggerate in either direction. It must be faced realistically, for the consequences of improper action could be grave.

From the time of the introduction of the first computer on the business scene we have heard the threat of widespread personnel displacement due to the devices imprudently labeled "giant brains" (a much more accurate label is "giant slaves"). We know that these assertions have at times been exaggerated out of reality.

Now we hear a cry at the other extreme that is perhaps just as dangerous. The cry that "There is no problem." There **have** been personnel problems associated with the introduction of data processing equipment. There would have been many more problems if management had not anticipated and corrected the more serious of these before they could take effect.

During the past ten years about five thousand computers have been installed. It has been estimated that as many as thirty thousand additional computers will be installed in the **next** five years.

The newly formed Office of Automation and Manpower in the U. S. Department of Labor will certainly be watching this immense influx of activity, prepared to take whatever action it deems necessary.

We believe American management is highly courageous and farsighted. We believe that it recognizes the best way to avoid union and government interference in its operations is for each individual business concern to face and solve its own problems. The result of enlightened action can be an era of unparalleled prosperity.

As an aid to management we will publish, starting with this issue, case histories of companies that have successfully met the personnel displacement problem. In this way we hope to make some positive contribution to the avoidance of a "national" problem. ■

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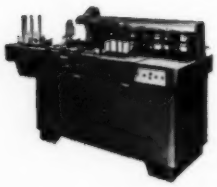

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